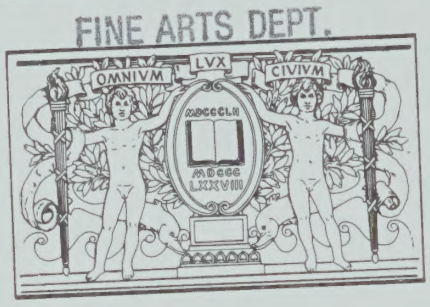

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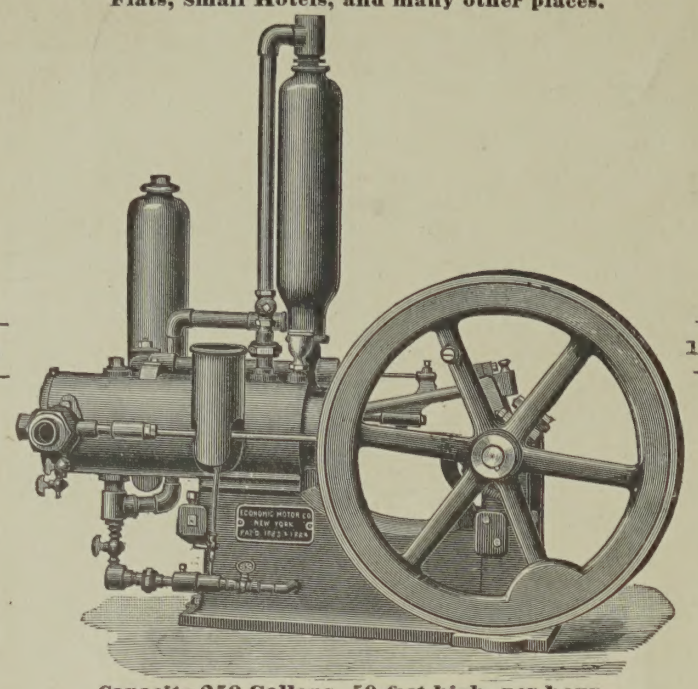

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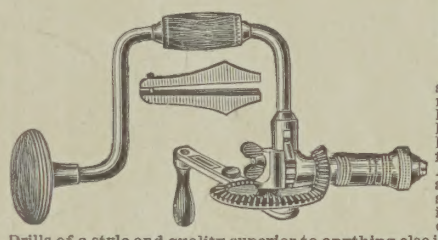

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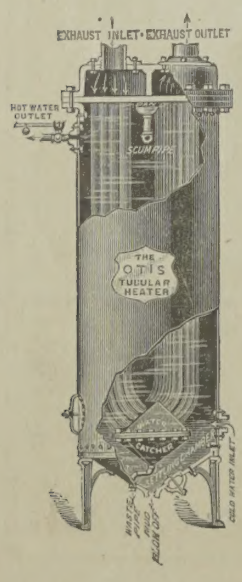

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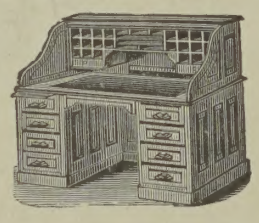

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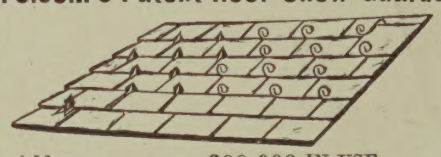

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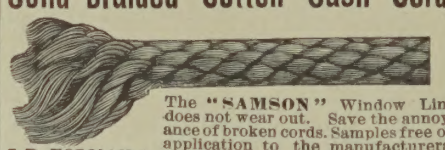

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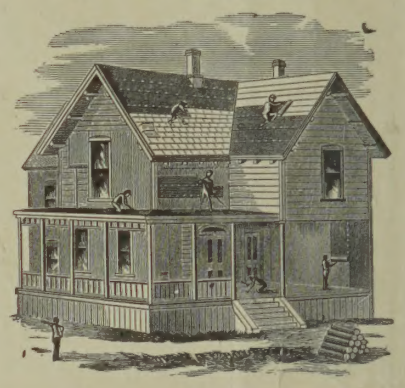

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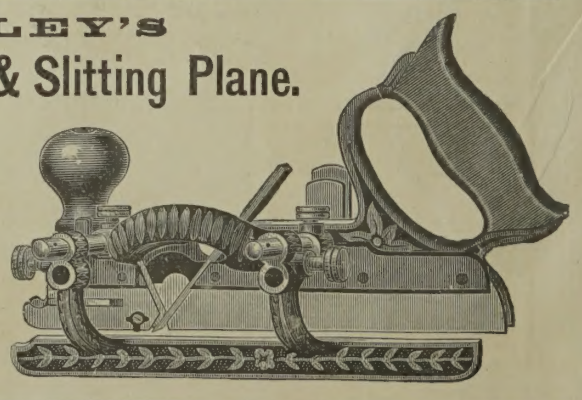

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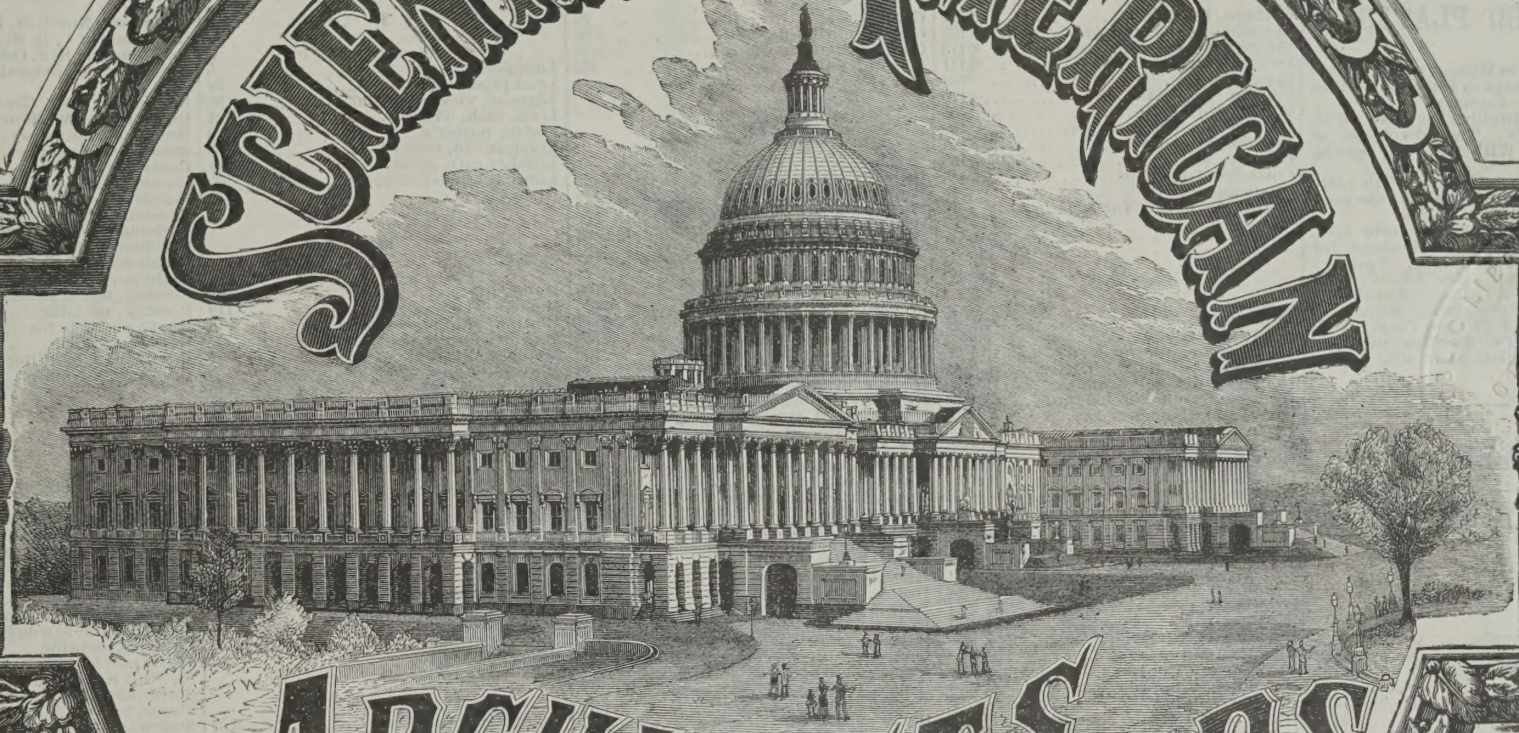

ARCHITECTS AND BUILDERS EDITION.

Vol. V.

JANUARY—JUNE,

1888.

MUNN & CO., PUBLISHERS,

No. 361 Broadway, New York.

G.A.AVERY.SC

INDEX.

VOLUME V.—JANUARY–JUNE, 1888.

Articles Marked * are Illustrated.

COLORED PLATES.

I. A residence in Michigan. With plate of details. A Cottage for $1,000. With plate of details. January.

II. A colonial dwelling for $5,500. With plate of details. Two dwellings at Orange, N. J. With plate of details. February.

III. Suburban residence. With plate of details. A Cottage of moderate cost. With plate of details. March.

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MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

SCIENTIFIC AMERICAN

ARCHITECTS AND BUILDERS EDITION.

Entered at the Post Office of New York as Second Class Matter.

Vol. V. Subscription, $2.50 a Year. NEW YORK, JANUARY, 1888. Single Copies, 25 Cents. No. 1.

A GARDEN PAVILION NEAR PARIS.

[For description see page 4.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, JANUARY, 1888.

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CONTENTS

Of the January number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

TO OUR READERS AND PATRONS.

The present number is the first of a new year, and with it we begin our fifth volume. This is the period when subscriptions are payable, and we ask our patrons to be prompt in sending their renewals, thus avoiding the loss of any numbers. The terms are only $2.50 a year.

Considering the wealth of illustration, the variety and value of information presented, this work is by far the cheapest of anything in the same line.

To builders and those contemplating the erection of dwellings or other structures, our paper has proved to be of great value.

With every number, during the past two years, we have given plates in colors of many new buildings, with specifications, accompanied by extra special sheets of details. In most cases these have been so complete as to enable the builder and contractor to proceed at once with the construction; and on the plans thus presented, thousands of new buildings have been erected in all parts of the country. In almost every town in the land attractive dwellings are now to be seen, which, on inquiry, will be found to have been built from SCIENTIFIC AMERICAN plans.

No architectural publication in the world presents to its patrons so many practical specifications and drawings without cost, except the merely nominal subscription rate of $2.50 a year. It is hardly necessary to remind the builder that he would be obliged to pay several hundred dollars if the same number of plans were to be specially prepared for him.

In addition to the colored plates, details, and specifications, we have furnished a large number of other new architectural illustrations and many pages of valuable information. In all, the past year's volumes include about one thousand engravings.

We remind our readers of these items with the hope they will mention them to their friends, and if possible to secure a new subscription, to send it in with the renewal of their own.

Our aim is to improve and enlarge the sphere of work, rendering it more and more valuable. To this end we need the support and encouragement of as many subscribers as possible. If each one of our friends will do a little for us in this direction, all the parties concerned will derive benefit.

If any of our readers have inquiries to be answered, or suggestions to make, relating to subjects or features they would like to see treated in our paper, we shall, at all times, be pleased to hear from them.

Architects and builders who desire to see their plans reproduced in our pages are also invited to communicate with the editor.

KEEP OUT THE WATER.

As soon as a house is completed, the four elements conspire against it to destroy—the earth to dampen and force in the foundation, the air to blow the structure into pieces, the heat to warp the coverings and open the joints, and the water to enter them and hasten decay.

This last enemy is the worst of all, and if *it* can be kept out, the first named may be rendered comparatively harmless. How, then, can the water be kept away *from* and *out of* a house? This is, indeed, a most important question, for upon its successful solution will depend the health of the occupants and the permanence of the building. In the first place, the cellar must be constructed so that it *will be dry.* This can easily be done by giving to the house a good elevation above the ground, so that the cellar bottom will not be more than three feet below the original surface of the ground, thus giving ample space for filling in around the foundation wall with earth, and at the same time affording a good slope away from it. It is a great mistake to place a house low, near the ground, over a deep cellar, as was formerly done for the sake of style. It is much better to have a high stoop than a damp cellar. It is well, too, that there be many windows of good size to admit the light and air, for, without these, everything else that may be done will be of no avail. If the surface water is kept well away from the house by grounds well sloped, the other precautions mentioned in a previous number of this paper will be all the more effectual, such as underdraining the foundation wall, cementing outside of the same, etc. A dry cellar is so great a desideratum that it should receive the first consideration.

After this comes the superstructure, which should be so built that the water will get away from and out of it as quickly as possible. The water table should project over the foundation wall, otherwise the soakage will get under the sills and rot them. There should not be any projecting balconies without roofs. This is the case with a house now before me; the consequence of which will be speedy decay, not only to the exposed portions but also to the sills of the house into which the supporting beams are mortised. These unprotected balconies and piazzas may be ornamental, but they are neither useful nor durable.

Water gets into many houses through the window casings, because component parts are carelessly prepared and nailed together, leaving openings through which the driving rains may penetrate to the great damage of the plastering and decorations within. When this is found to be the case, the only remedy is to calk up the cracks with oakum and cover this with white lead or putty. Many a leak of this kind evades search, because it is more often than otherwise above the place through which the water appears. Begin at the top in your examination and then go down; *not* at the bottom and then go up, as is generally done, and as generally without success. The writer once had great annoyance and some damage because of a leak which wet the carpet in the hall of his house, adjoining the parlor partition. This occurred after every heavy rain, and yet all seemed water tight round about. Where could the water come from? was the constant query. A diligent search during a driving rain discovered the opening at the chimney (which came out at the apex of the roof), between the bricks and the rafters which were against them. Through this the water came, and instead of dropping at once upon the plastering beneath, it followed the rafters down to the supporting uprights and thence upon the floor below. It is important to frequently examine carefully around the chimneys at the roof, and to fill up the cracks with some waterproof material.

A RESIDENCE IN MICHIGAN.

Our colored plate and sheet of details represent a comfortable dwelling, which may be erected for about $9,500, as follows:—

Carpenter work and painting	$5,200
Mason work	3,200
Plumbing, range, etc	875
Heating	250
	$9,525

The following is an abstract from the specification.

MASON WORK.

The cellar is to be excavated to an average depth of about 4′ below the natural grade. Trenches for all exterior foundations and drains to be dug at least 2′ 6″ deep, except soil drain. This to be 3′, and all excavations that are necessary to carry out the plans, such as drains, piers, steps, vaults, and other foundations, to be well and faithfully done. The earth to be filled in and packed against the cellar walls after the mortar is dry, and level with the top of grading. Also trench under foundation walls and exterior walls and piers, and all other necessary excavations required.

All drain pipe to be of best quality drain tile. These pipes to be properly graded. Make all joints clean and tight with cement. Run a 5″ soil pipe from inside of cellar wall to sewer. Run a 3″ line from cellar bottom to nearest outlet; 3″ drain pipe from all leaders to connect to the cellar drain. Furnish and fit all necessary bends, crooks, etc., to make this piping complete.

FOUNDATIONS AND STONE WORK.

Footing to be laid under all walls and piers, both stone and brick. All footing courses under stone walls to be of concrete, 4″ wider each way than the walls resting thereon, and 4″ high, well bedded in. The top of this footing course to come level with the top of cemented cellar bottom.

All footings, piers, foundations, and stone walls to be built to correspond with the sizes marked upon the plans. The stone used in the foundations to be of approved medium size stone, the lower courses to be laid with extra large flat stone; all to be carefully bedded on their broadest faces; all laid in water lime mortar composed of one part water lime and three parts coarse, sharp sand and one part Rosendale cement, each layer well filled and flushed up on both sides and firmly bound together. The foundation for steps, porch piers, etc., to be built as above, and to extend at least 2′ 6″ below grade, all the foundations for outside piers to be solid concrete and slightly taper equally on all sides from bottom up, the stone wall coming against the earth to be well cemented on the outside to the top of ground, after it shall become dry. Run a line of 3″ unglazed tile all around foundation and to grade to cellar drain. These tiles not to be jointed with cement.

All face walls above grades to be laid with approved quarry stone. All to be carefully set and bedded on their broadest faces, well bonded together, and backed with stone of same quality. All well laid in cement mortar, two parts Rosendale cement and three parts sharp screened sand nicely cleaned off. The face stone to be pointed with Rosendale cement mortar made in the best manner, and cut joints on the outside, and flush pointed on the inside with cement mortar. The foundation wall to run to top of the floor beams, which will be eight feet from top of cement bottom.

All stone and brick work to be perfectly plumb and level. All brick work represented by plans to be of well burned hard brick throughout, which must be laid wet in warm, dry weather, or, if laid in damp, freezing weather, the brick must be kept perfectly dry. All brick to be laid up in best and most workmanlike manner, with mortar composed of good lime and clean, sharp sand, in the proportion of two of sand to one of lime, and one part Rosendale cement inserted just before using. All piers and walls to be built as represented by plans and of such dimensions as marked

thereon. All the entire outside walls of building on second story filled in solid with brick, from top of girts solid up under second story floors.

The chimneys to be built and carried up as represented by the drawings, with Trenton pressed brick, laid in red mortar, as above specified. All flues to be struck joints on the inside, and left free and clean on the completion of the work. All chimneys to be topped out as per elevations, with axed bluestone caps 3" thick. All chimneys where exposed to view on exterior to be of Trenton presed brick. The fireplaces in dining room, parlor, library, and main hall to be pressed brick, also one chamber fireplace in second story to be pressed brick.

Turn trimmer arches to all fireplaces. Furnish and set all necessary bluestone sills to all cellar windows, also furnish and set all necessary bluestone steps and copings, rubbed bluestone hearth and shelf for kitchen. Other hearths to be tile furnished by the owner and set by contractor. Fine tooled brownstone sills to all windows coming in stone work above cellar.

The walls and ceilings of all the rooms and apartments, where shown, must be lathed and plastered with two good coats of sand lime and long goat hair mortar, brown finish and scratch coat, this to be covered with a good, hard finishing coat of plaster of Paris, well troweled. All lime must be thoroughly slaked and made up at least eight days before using in the building. The whole job of plastering to be done in the best manner; and all repairing and patching, to leave the work in perfect condition, must be done at the completion of the building. The under side of all staircase to be plastered where required by the plans.

All the principal rooms and halls in first story to have neat moulded plaster cornices, 8" on ceiling and 6" on side wall; also centerpieces, in same rooms, to cost at least $3 each

The cellar bottom must be leveled off, packed and settled thoroughly and covered flush and smooth with cement concrete 3" deep in three parts of clean, coarse sharp gravel and one part paste and Portland cement, and the entire surface to be flushed up even and true around the sides of the main wall or gutters, sufficient to carry all the water to the drain. Over the mouth of the drain place an iron strainer, and leave the whole job or work in perfect order.

All manner of iron and blacksmith work necessary to make the whole job or work complete to be done and finished in a satisfactory manner, subject to the approval and direction of the owner.

CARPENTER WORK.

First floor joists.....	2"×10"	16" from centers.
Second floor joists.....	2"×10"	16" "
Third floor joists.....	2"× 9"	16" "
Ceiling joists.....	2"× 6"	24" "
Rafters.....	2"× 6"	24" "
Partitions	2"× 4"	16" "
Bearing partitions....	3"× 4"	16" "
Studs in outside walls.	2"× 4"	12" "
Door studs..	2"× 4"	doubled.
Wall plates and ties..	4"× 6"	
Bridging.....	2"× 2"	
Furring strips and shingle lath.....	1"× 2"	
Sills	3"× 8"	
Posts	4"× 6"	
Girths..... ...	4"× 6"	
Ridges	2"×10"	
Piazza sills and bearing timbers.....	3"× 8"	
Piazza floor beams ...	2"× 6"	20" from centers.
Collar beams..... ...	2"× 6"	

All other necessary timber required throughout the building to be good, sound pine timber, well seasoned, sawed true and square, free from sap, shakes, dry rot, or other imperfections, and all timbers used throughout must be prepared and framed according to the plans, sections, and details. All joists to have the crowning edge placed upward and sized to proper widths. Also prepare and size all studding, etc. Cross-bridge all joints at distances not exceeding eight feet apart. All trimmers and headers must be framed double, and in no case allow less than two inches between chimney breasts and trimmers.

The carpenter must provide and set all wood lintels of every kind and description for all windows, doorways, and other necessary places for mason. All lintels to have a bearing on walls of at least two inches on each end.

All partitions throughout the building to be set according to the plans. Bearing partitions on first floor must foot upon the sills below, and be capped on second story with plate for the reception of the beams. Bearing partitions on the second floor to foot upon plate. The studs at angles to be thoroughly spiked together before being placed in position. All doors to be trussed over the top thoroughly and substantially where necessary. All partitions to be set to a straight edge. Joist in all cases to be doubled up under all stud partitions. Grounds put on for finish throughout the building. Bridge partitions once in their height with 2×4, cut in horizontal, well nailed.

The carpenter must do all cutting for pipes of all kinds, using care not to cut off or weaken supporting timbers, and furnish all necessary pipe boards for the plumber to screw his pipes to. Also do all necessary cutting for the heater man.

The lumber to be white pine, unless otherwise specified. All inside finishing lumber to be clear and dry, free from sap, shakes, knots, pitch, etc. Sound and thoroughly seasoned. The bath room and water closet fittings will be of dark ash. The dining room and main hall, including the ceiling of hall, and the doors in their respective places, to be of dark ash.

All of the exterior finish for corner boards, window and door casings, cornices, water tables, verandas, 5" beveled sidings, and all manner of finish shown on plans and details to be composed of clear white pine, well seasoned, and primed as soon as put up. Siding laid not more than 4" to the weather. Shingle the vertical sides where shown on the plans with 6"×18" pine shingles, laid not more than 5" to weather, and cut to pattern.

The entire vertical sides of house to be sheathed with matched pine boards, put on horizontal and well nailed to each and every nailing, covered with heavy Manila building paper.

Do all necessary furring of every description, including the furring of the stone walls which come in the first story.

All roofs to be covered with 1"×2" spruce lath, 5½" apart. Do all of the rough carpentry work necessary to form the projection of eaves, as required for all cornices, gutters, etc., to be done in accordance with the plans and details. All to be composed of good, sound lumber, and put on in a good, substantial manner. All main roofs to be covered with the best quality 18" pine shingles, laid not more than 5½" to the weather, two fourpenny nails to each shingle.

All floors, when not otherwise specified, to be of white pine, free from shakes, black, unsound or loose knots, mill worked, tongued and grooved, 1" thick, not over 4½" wide. The attic floor may be 9½" flooring of same quality. All well and secret nailed to each beam. The porch floors to be of white pine, tongued and grooved, 1¼" thick, not more than 3" wide, and all joints to be well laid in white lead.

All doors in the house, except where otherwise specified, to be made of clear, dry white pine, free from sap, and must be in strict accordance with the drawings. Size of doors to be marked on floor plans for widths, height, etc. All doors that are marked on plans as sash doors to have proper rabbets for receiving glass and suitable provisions for same, with beads, etc.

All necessary dwarf doors to be provided where needed for pantries, closets, wash stands, water closet, etc., paneled or battened and beaded, as the case may require. The front door to be made of dark ash to correspond with the sizes and dimensions given on plans. All other doors required by the plans to be made in the best manner, and of good, sound, clear, kiln-dried lumber.

The sliding doors to be hung with Hatfield's 4" patent sheaves and brass track. The double sliding doors to have astragal joint in center. All to be well and securely done. Pockets for sliding doors to be made perfectly air tight.

Hang all doors throughout with loose joint butts of sufficient size to throw them clear of architraves. Butts on front door to be of plain bronze, 5" × 5", three to the door. Butts on principal rooms and hall to be of 4½" × 4½" plain bronze. All doors to have 4½" cherry saddles and base pins where needed. All dwarf doors throughout to have suitable butts to match other work, and all doors on principal part of first story to be real plain bronze. Roses and escutcheons bronze. Front doors to have plain bronze knobs and escutcheons and roses combined, on the outside. Doors on second story to have 4" × 4" lacquered butts and hemacite knobs. All other doors throughout to have plain iron butts and white porcelain knobs and escutcheons. Sliding doors to have real bronze flush trimmings. Put suitable knobs on all dwarf doors, press doors, etc. The principal part of first story to have bronze face mortise locks. The main entrance door to have a 6" mortise lock, night latch attachment, with three keys, and to have real bronze fronts and striking plates. All doors in principal part of first story to have a first quality 4½" mortise lock, real bronze front and striking plates. Sliding doors to have locks and astragal fronts of real bronze and flush furniture. All small closets, presses, drawers, etc., to have suitable locks, as approved. All door locks throughout to be of the best city manufacture, and each door to have a key. Kitchen and second story doors to have 4½" brass face mortise locks. Front door to have mortise bolts, of suitable size and finish, to be of real plain bronze. Also put bolts on the outside doors.

Put up 2" picture moulding in all principal rooms and halls, first and second stories.

Furnish and put in three wash trays where shown on plans, made of clear and perfectly dry white pine lumber. 1½" thick dadoed together in white lead, well spiked and to be watertight. These to have panel [illegible] and flush on [illegible]

up on turned legs. Size to be as directed by owner. All window frames constructed to correspond with the working drawings for same. The sash to be size as shown and 1½" thick, and hung on braided sash cords, weights of suitable weight and noiseless axle pulleys. All glass to be well bedded, bradded, back puttied, and cleaned off. All provided with best approved bronze sash locks and lifts. All made of clear white pine, well seasoned. The cellar windows constructed in accordance with the details for same, and the sash to be all hung on back flaps and secured with hooks and staple. The sash coming in rooms where hard wood is used to be of same materials.

The balconies over the tin roofs to be covered with slat floors, slats ⅞ × 2½", ⅛" apart, screwed to bed pieces 1¼" thick, with 1½" screws, made in sections so they can be easily taken up; these strips to be painted before being put down.

The glass in first and second stories to be second quality double thick French sheet glass; the balance to be third quality French sheet single thick. Furnish and put in frames for stained glass windows. The stained glass will be furnished by the owner, and set by the contractor.

All hardware and trimmings used throughout to be the best of the kind specified. Furnish all necessary brass hardware for bath room, for water closet covers, etc. The interior finish to be constructed as required by the plans and details, with sound, clear, kiln-dried white pine, unless otherwise specified. All put up with neat, close joints, smoothed up and sand-papered. Base put down in all apartments which are not wainscoted; 8" wide with 2" moulding on top. Beads to be put on all plaster corners. The bath room and water closet to be fitted up with dark ash. Panel backs under windows first and second stories; all windows, including those that have panel backs, to have neat stools and aprons.

All stairways to be built where located on plans. The main staircase to be built and supported on three plank strings, the risers to be 1" thick and the treads 1¼" thick. Dimensions in all cases for height of risers and width of steps to be measured from the building. The space under stairs to be finished with a neat dark ash panel, and finish toilet closet as shown. All stairways must be put up after the plastering is dry. The attic and kitchen stairs built as required by the plans of a good quality of stock, to be well supported on two 1½" plank strings, to have ⅞" risers and 1¼" treads well housed in to wall string. The main stair treads to be dark ash.

The newels, rails, and balusters for main staircase to be of selected dry dark ash, worked in accordance with the detail drawings. Treads and strings 1¼" thick. Cellar stairs to be built on good strong plank strings, provided with plank steps 1¼" thick, of white pine, well put up and thoroughly secured. The main newels will be 10 × 10 base and 7 × 7 shaft, turned and squared; rail 3½" × 4" moulded, balusters 2" × 2" square and turned, the newels at the top and on the landings of the main stairs, 5 × 5 square and turned, rail for same 3½" × 4", round, and 2" turned and square balusters. The attic stairs to have a plain neat pine rail, strongly put up.

Bedroom closets to have two rows of double wardrobe hooks, placed on beaded cleats, and two rows of shelves put in across the top and back and sides where space will permit The closet of second story hall to have a set of four drawers 10" deep × 20" wide ×4' 6" long, cased in complete and the drawers lined with Spanish cedar.

The kitchen pantry to be shelved regular on three sides, 5 shelves high, and shelves about 14" wide. The china closets in dining room to be regularly shelved from bottom up.

Fit up kitchen sink with dark ash drainer, and wood band around edge of sink; and as may be directed by the owner.

Wainscot walls of kitchen, dining room, and bath room with beaded battens, 2½" wide, and cap with a neat beveled and moulded cap, the bath room to be of dark ash and the kitchen yellow pine, all to be 3' 6" high and 20" above the fittings.

The mantels, either slate or wood, will be furnished by the owner, and set by the contractor.

Bath tub to be cased up in a good and workmanlike manner. The water closets to be fitted up with cover, seat, and riser. Hang the seat and cover with brass butts. The whole should be put together so that any time they may be easily taken apart for the purpose of attending to or repairing the plumbing pipes Fit up the wash bowl underneath with narrow ceiling 2½" wide, and provide batten door of same, properly fitted, hinged, and trimmed with appropriate butts and catches. All the wood fittings to be of dark ash.

All windows except cellar and stained glass, to have four-fold inside blinds made of dark ash and hung, and fastened complete with bronze hardware; attic to have outside rolling blinds, fastened complete when shut or open.

All the flat roofs, including piazza, must be covered with the best I. C. charcoal roofing tin, laid with flat [illegible] The gutters to be properly lined, and run the

tin up under the shingles at least 6″, bring the tin over the face of the cornice and tack it down smoothly. All angles and other necessary places to be covered with tin as above, all well soldered in resin and made perfectly watertight. Leaders of XX tin put up as indicated on plans, or as may be directed, with all necessary curves, breaks, bends, etc., to carry the water from the several roofs to the ground and connected tile drain, which will be put in by the mason. Leaders to be of 3″ caliber and thoroughly secured with iron hooks as directed. Where tin work of roofs comes against chimneys the tin must turn into the bricks and be thoroughly secured with gas hooks and counterflashed. All proper and necessary places to be flashed, whether specified or not, and everything requisite to make all places watertight, must be done. All leaks to be stopped after other craftsmen, and everything left perfectly watertight on the completion of the building. The tin at all junctions must run up at least 6″ high.

All the materials used through the building to be furnished of the best quality, and all labor to be performed for the full and complete painting of the building. All the exterior wood and iron work must have three good coats of pure English white lead and American linseed oil, colored as directed. Paint all the tin work with Prince's metallic paint. Cover all sap, knots, etc., of wood work with a good coat of strong shellac before priming. Putty up all the wood work smoothly after priming. The entire inside to be wood filled with Wheeler's wood filler, and to have two coats of hard oil finish and rubbed down to an eggshell gloss. For bath room and main stair treads use David B. Crockett's No 1 Preservative, also paint the blinds three good coats, color as directed.

PLUMBING

Furnish and put in where shown on the plans a 4″ cast iron drain pipe, to run from inside of building out to the tile drain 4′ outside of the building. Use Y branches for all iron pipe connections.

Furnish and connect with the drain in cellar a 4″ cast iron soil pipe and run same size up and out of roof at least 4′ above highest point, and cap the same with the "Smith" patent ventilating cap. Use Y branches for all waste connections. All the iron soil pipe to have a coat of asphaltum. The soil pipe to have a cleaning out cap in cellar.

All joints of all iron pipes are to be thoroughly calked with picked oakum and molten lead and screwed in position with iron hooks. All joints between iron and lead pipes to be made with brass ferrules, to be calked into iron pipes, and lead pipes soldered to it with wiped joints.

Furnish and put up where shown on plans a 35 gallon round head heavy pressure copper boiler and provided with a draw cock for emptying the boiler, and shut-off cocks for shutting the water off from the second story, and provide with circulating pipes complete. Connect boiler draw cock with the sink waste, have a ⅝ stop cock on supply pipe, and combined safe and vacuum valve on top of boiler. Boiler to be supplied with a "Lockwood" stand.

Tap and pay for tapping water main and connect a ⅝ AAA supply, and run to the boiler. Supply to have a shut-off cock inside the cellar wall. All pipes are to be graded so they will drain perfectly dry, each floor to be controlled separately by shut-off cock. Where pipes will not drain dry, put in a small pet cock.

Sink.—To be a Mott's Eastlake galvanized, with back, air chamber, and iron legs. Furnish and set up where shown in the kitchen a 18×30 sink, and supply with hot and cold water through ⅝″ AAA lead pipe and Fuller cocks, and to have 1½″ C lead waste pipe properly trapped, and connected with the drain with a 2″ iron pipe to the main soil pipe. To have a cleaning cap on end of pipe under sink.

Bath.—Furnish and put up where shown a 16 oz. sheet copper bath tub, 5′ long, well tinned and planished Supply with hot and cold water through ⅝ AAA lead pipe and nickel plated combination bath cock with rubber spray, to have 1½″ C waste, and to be properly trapped and connected with the soil. Bath to have nickel plated plug and chain Overflow to be connected with waste.

Bowl.—Furnish and set where shown on the plans a 14″ marble Italian ware wash bowl, with marble countersunk top and surbases 10″ high. Supply with hot and cold water through ½″ AAA lead pipe and nickel plated Fuller patented basin cocks. To have 1½″ C lead waste, properly trapped and connected with the soil, to have nickel plated chain and stay and plug.

No cocks to be placed at the end of a line, but the pipe to be extended so as to prevent jarring directly on cock.

Closet.—Furnish and set in the bath room where shown on plan, supplied with water through 1¼″ pipe from cistern above, an "Inodoro" porcelain wash out closet, with suitable size cistern. The cistern to have the flush tank attached supplied through ⅝ AAA pipe and have cistern valve and rubber ball complete. Ventilate the closet with a 3″ lead pipe, connected with the iron vent. Closet cup and pull to be nickel plated, and to be inserted in the seat. Closet to have enameled drip tray.

The bath tub, bowl, and closet are each to be provided with 2½ lb lead safe pans. Edges turned up 2″ all around, and to have a ¾″ lead waste pipe to the cellar.

Wash Trays.—Supply the wash trays with hot and cold water through ⅝ AAA lead pipe and Fuller patented cocks with flange and thimble. Provide with a 2″ main waste pipe properly trapped and connected with main soil, provide necessary plugs, chains, and flanges; also provide on end of pipe a cleaning cap.

Every trap through the house to be separately and independently ventilated from the crown by the same sized pipe as trap.

Put up the gas pipes with outlets where shown on the plans and according to the rules of the gas light company. All outlets are to be capped and all pipes tested. All side lights are to be not less than 5′ 6″ from floor. all drop lights are to be hung plumb.

Put in complete a No. 6 J. L Mott's low down "Defiance" range with water back. Make all necessary pipe connections.

Heater.—Furnish and erect in a good, substantial and workmanlike manner a No. 10 Economy warm air heater, with double casings, to heat the first and second floors at 70° F. Provide Tuttle & Bailey's black japanned bordered registers

The smoke pipe to be of galvanized iron, and all tin pipes to be IX bright charcoal tin. All tin pipes to have proper dampers near furnace, also patent damper in smoke pipe, with regulating chains. Finish and complete the apparatus in all respects and leave the same in perfect working order. Registers and steam coils to be located and directed by the heater man.

A DWELLING OF MODERATE COST.

The following is an abstract of the specification for the dwelling shown in our colored plate. For enlarged details see thin sheet.

MASON WORK.

Excavate for cellar under the entire house to an average depth of about 3′ 6″. Foundation to be built of good hard burnt brick, 6′ 6″ high in clear of cement bottom to under side of floor beams. Foundation wall to have footing course underneath. Build brick piers in cellar and under stoop as shown, 8″×8″, and desired height. Bluestone sills for all cellar windows. Build chimney as shown, of good hard burnt brick, struck joints inside and out. Put in thimbles where directed.

Cement the cellar bottom 3″ thick with Rosendale cement and screened gravel. Build cistern 8′×8′ in the clear, with common brick, domed on top, covered with flat stone, and cemented inside, perfectly water tight. Connect all water leaders to cistern with 3″ earthen drain tile. Build cesspool where directed, 8′×8′ in the clear, with rough field stone, covered on top with flat stone, the top to be domed. Connect to sink waste with 4″ drain tile. Plaster the entire house, except cellar, with one coat of brown mortar, and skinned. These walls to be put on Hall's patent sheathing lath. The sheathing lath will be put on by the carpenter. All the work to be done in a good and workmanlike manner.

CARPENTER'S WORK.

The house will be framed in the ordinary way. For size of timber see list of materials. The floor timbers and studding 16″ on centers; rafters 24″ on centers, sided on the studs, with 6″ beveled siding, and paper underneath. Roof to be covered on 1″×2″ lath, with 18″ XXX pine shingles, not over 5½″ to the weather. Also shingle on the vertical sides where shown. Piazza, stoops, cornice, etc., all to be constructed as per details. Porch roof, gutters, and leaders to be XX tin. Window frames, door frames, corner boards, etc, all as shown. All the floors, including porch floor, will be merchantable white pine, 4½″ wide and ⅞ thick Partition studs 2″×4″, 16″ on centers. Door and window studs doubled. All the entire vertical sides of partitions and the outside walls, also the ceilings, and everything that will be plastered inside, to be sheathed horizontal with Hall's patent sheathing lath well nailed to each and every nailing with eightpenny nails.

All the sash will be 1½″ thick, hung on weights. All windows except cellar to have outside rolling blinds, fastened complete, when shut or open. All room and outside doors four paneled, flush moulded, and 1½″ thick. Closet doors 1¼″ thick. All doors to have hard wood saddles; all butts to be 3″×3″ cast loose pin; room doors to have mortise locks; closet doors to have reverse bevel rim locks; furniture to be white porcelain drop escutcheons and nickel plated shanks. All inside trimmings as per details. The stair balustrade will be ash. All the closets throughout to be fitted up as directed. Bedroom closets to have hanging hooks. Fit up in pantry, where shown, an 18×30 cast iron sink, set up on legs and mounted with a No. 2 Douglass lift pump. Make all necessary connections with cistern and cesspool. Furnish and set mantel as shown on details, of ash. Put up small shelf in kitchen, supported on two iron brackets

Paint entire house inside and out with two coats of lead and oil. Color as directed. Stair balusters, with brass butts, and hand rail, and all hard wood work to be done in a workmanlike manner.

BILL OF MATERIALS AND ESTIMATE.

2 sills,	3″×8″×18′ =	72 ft.	
2 sills,	3″×8″×22′ =	88 "	
1 girder,	4″×6″×22′ =	44 "	
32 floor beams,	2″×8″×18′ =	768 "	
4 posts,	4″×4″×16′ =	86 "	
2 posts,	4″×4″×12′ =	32 "	
2 ties,	4″×4″×12′ =	32 "	
2 ties,	4″×4″×22′ =	59 "	
2 plates,	4″×4″×22′ =	59 "	
1 plate,	4″×4″×12′ =	16 "	
8 rafters,	3″×4″×16′ =	128 "	
24 rafters,	3″×4″×12′ =	288 "	
150 studding,	2″×4″×12′ =	1,200 "	
		2,872 " at $17 per M.	$48 82
1,200 ft 6″ beveled siding, at $30 per M.			36 00
2,500 ft. Hall's sheathing lath at $20 per M.			50 00
1,200 ft. building paper, at $2.50 per M.			3 00
1,000 ft. 4½ pine floor, at $30 per M.			30 00
5,000 pine shingle, at $5 per M.			25 00
140 1″×2″ shingle lath, at 2 cents each.			2 80
1,000 ft. 1¼″ pine lumber, at $30 per M.			30 00
1,500 ft. ⅞″ pine lumber, at $30 per M.			45 00
200 ft. 2″ pine lumber, at $30 per M.			6 00
4 pair sash, size of frame 2′ 6″×5′ 2″, at $1.50 per pair			6 00
4 pair sash, size of frame 2′ 6″×4′ 6″, at $1.50 per pair			6 00
1 pair sash, size of frame 2′×5′ 2″, at $1.50 per pair			1 50
1 pair sash, size of frame 2′×3′ 6″, at $1.00 per pair			1 00
1 pair sash, size of frame 2′×3′, stained glass marginal lights			1 50
1 front door, 3′×7′×1½″, at $2.50			2 50
1 sash door for rear, 2′ 6″×6′ 8″×1½″, at $2.50			2 50
2 doors, 2′ 6″×6′ 8″×1½″, at $2.			4 00
2 doors, 2′ 6″×6′ 8″×1¼″, at $1.50			3 00
2 doors, 2′ 6″×6′ 6″×1¼″, at $1.50			3 00
2 doors, 2′ 4″×6′ 6″×1¼″, at $1.50			3 00
1 door, 1′ 8″×5′ 6″×1¼″, at $1 50			1 50
1 door, 2′ 0″×6′ 0″×1¼″, at $1.50			1 50
4 cellar sasb, at $1 each			4 00
6 1¼ spruce plank, for cellar stairs			1 50
2 4″×4″×6 chestnut posts, for back stoop.			50
2 5″×5″×8′ 6″ pine posts, for front porch.			2 00
6 quarter circles, for front porch			60
100 ft. 3½″ beaded ceiling, for ceiling of porch and partition under stairs			3 50
1 ash newel, 6′×6″, turned			2 50
1 ash newel, 4′×4″, square			1 00
60 ash balusters, 1″×1″, square, at 6 cents.			3 60
30 ft 2½″×3″ ash rail			3 00
140 ft. cornice moulding, at 3 cents			4 20
60 ft. gutter, at 10 cents			6 00
40 ft. 3″ tin leader, at 12 cents			4 80
250 ft. 4½″ moulded casing, for first story, at 3 cents			7 50
160 ft. 2″ base moulding, at 1½ cents			2 40
26 corner blocks, at 5 cents each			1 30
16 base blocks, at 5 cents			80
1 sink, pump, and connections			20 00
Hardware			35 00
11 pair of blinds			22 00
1 mantel			15 00
Carpenter work			225 00
Painting			60 00
Mason work and materials			250 00
			$989 82
Sundries			10 18
			$1,000 00

A GARDEN PAVILION.

We give on our first page, from the *Moniteur des Architects*, the elevation of a garden pavilion which is rather suggestive and picturesque.

Improvement in Frescoing.

Anthony Mahler, of Cincinnati, has invented a new process for frescoing ceilings, which is principally notable for its cheapness, convenience, and ease of application The frescoing is done on canvas and then applied to the ceiling in squares with wooden panels, which serve the double purpose of holding the canvas to the ceiling and dividing that into panels of any required size or shape. One of the advantages of this style of frescoing is that the work may be done in the studio, after which it is put up in the shortest time and with the least trouble and inconvenience to the occupants of the house undergoing the artistic adornment. The new process has been applied in a number of buildings, and it certainly makes a very beautiful and artistic appearance that can hardly be detected from the real frescoing on the plaster.—*West. Arch. and Builder.*

It is said that scales for weighing diamonds are brought nearly to that delicacy of balance which would enable dealers to detect flaws in the stones by minute variations in weight. They weigh accurately to the 20th part of a carat.

RESIDENCES AT SPRINGFIELD, MASS.

We give two drawings of dwellings at Crescent Hill, Springfield, Mass. No. 1 shows the residence of the late W. H. Wesson, No. 2 the residence of C. B. Ireland. There is an air of real comfort and substantiality about these houses. Springfield can boast of many very beautiful and attractive specimens of domestic architecture.

American Architecture of Fifty Years Ago.*

Architecture was then understood and practiced as a separate profession by very few persons. I think it is safe to say that there are more architects in practice to-day in the city of Chicago than there were then in the whole United States. I think it is also safe to say that, with the exception of the science of electricity, architecture has made greater strides than any other of the arts and sciences. I claim that architecture combines both art and science to a greater degree than any other profession. To day we can vie with any country in the world in style and permanency of construction. Fifty years ago this country knew no style in architecture except the classic and the Gothic, and but very few pure examples of either of those styles were executed in this country. The majority of buildings at that period were planned and built by master builders, who usually made their plans on the face of the trestle board and shaded them with white, red, and blue chalk to designate wood, brick, and stone. Details were made, full size, in the same way. My father was a master builder, and used to make his own plans largely in the way mentioned. Architectural works in that early period were but few. Foreign works at that day were very expensive. I recollect the works of Benjamin Hill, La Fevre, and a few other authors, not to exceed half a dozen altogether. At the present time we have a

RESIDENCES AT SPRINGFIELD, MASS.

very large number of architectural publications and upward of three thousand practicing architects. I trust a majority of them are doing a legitimate commission business, and are not mere tools of contractors. Fifty years ago, and even less, architects were largely supported by contractors. Now, and for years past, the owners have found it for their interest to deal directly with architects. Still there are many impecunious persons who think that it is money wasted to employ an architect so long as they can get the services of one through their contractor, when by so doing they do, as a usual thing, indirectly pay three prices for their plans. I think I am correct in saying that Philadelphia is the largest city in this country which can boast that it has more buildings built in the last fifty years, in proportion to its inhabitants, without the employment of architects. They used to build miles of street fronts with builders to duplicate a certain mould with but slight variations to suit localities or notions of proprietors. That system, I am glad to say, is largely done away with even in Philadelphia, and architects' services are more fully appreciated. Still in Philadelphia there are, to-day, a less number of architects, *per capita*, than in any other large city.

When I came to Chicago, thirty-four years ago, I found the architects then in practice were recent master builders or contractors. Chicago and the West at that time could hardly be said to require the services of architects, separately as such. At that time the structures were but simple buildings, but the builders soon found that it would be better for them to have plans made rather than to spend their time in making plans. So they clubbed together, and induced one of the most apt in drawing plans to give up his contracting and to devote his whole time to architecture, and guaranteed him a compensation of two dollars per day, which should be paid to him if he did not get business enough to aggregate that amount. I have been told by a person who was acquainted with the early workings of the first architect of this city that he had an order for a set of plans for a dwelling, which he made and charged five dollars for them, and was much elated over the circumstance. From this small beginning others started, and on my arrival I was introduced by friends, or had letters of introduction to citizens, as a young architect from Massachusetts. This simply shows that as a profession it was not understood. It is not so now. No profession is better or more favorably known. Having mentioned the small compensation which architects were obtaining for plans, and that it came largely from contractors, I might state that when I commenced business in Chicago I immediately instituted the custom of charging a percentage on the cost of buildings as the only proper course to pursue, and always collected it from the owners. This departure was rather uphill work, but I have plenty of witnesses now to show that it was a success And from that small beginning we can, to-day, boast of as fine and as capable a corps of architects as any city of the Union, and the architect who first commenced practice in this city is still living.

* A paper read by Mr. W. W. Boyington at the convention of the American Institute of Architects.

Lapagerias.

The flowering time of these beautiful climbers reminds one how readily they can be raised from seeds, and when grown in this way there is always the pleasure of anticipation, though when the plants bloom the result is often disappointing. There are already in cultivation some varieties in which the flowers are beautifully mottled, and one of the finest marked blooms of this class that I have seen was a seedling. The flowers intended for seed should be artificially fertilized, as then the finest alone can be chosen for the purpose. The pods take a very long time to ripen, but when that happens the seeds should be taken out and rubbed up with a little dry sand, when they may be sown at once.

The soil best suited for the purpose is sandy peat, and the pots or pans in which the seeds are sown must be well drained. If plunged in a gentle bottom heat, the seeds very soon germinate. When above ground, a sharp lookout must be kept for slugs, which even in a single night will do considerable damage to a crop of seedlings. They will sometimes eat off the young plants just as they make their appearance through the soil, so that one may watch for them in vain, and till very closely examined the cause of the delay will not be discovered.

Aphides, too, do nearly as much damage, as in a few days they will cripple the young plants to such an extent that they will take a long time to recover. When the seedlings are sufficiently strong, they should be potted off into sandy peat, using for the purpose as deep pots as possible, for the roots of the lapageria run downward at once. In order to flower them as soon as possible, they must be grown on without delay, never allowing them to become stunted. If planted out when large enough, they will make more rapid progress than when confined in pots.—*T., The Garden.*

A DWELLING FOR $5,600.

The size of the structure is: Front, 40′; sides, 49′, exclusive of bays and piazzas. For size of rooms, see floor plans. Height of stories: First, 9′ 6″; second, 9′; attic, 8′; 2′ breastwork.

Materials.—Foundation stone to top of ground, 12″ brick underpinning. The entire house sheathed with hemlock boards. Sides clapboarded, except a band of shingles over tops of first story windows. Gables shingled. Roof, slate.

Cost, complete, without furnace and mantels $5,600.

SPECIAL FEATURES

There is a chamber on first floor hall, and three rooms open into each other by sliding doors. Each room except kitchen, on first and second floors has an exten

First Story Plan.

Second Story Plan.

A DWELLING FOR $5,600.

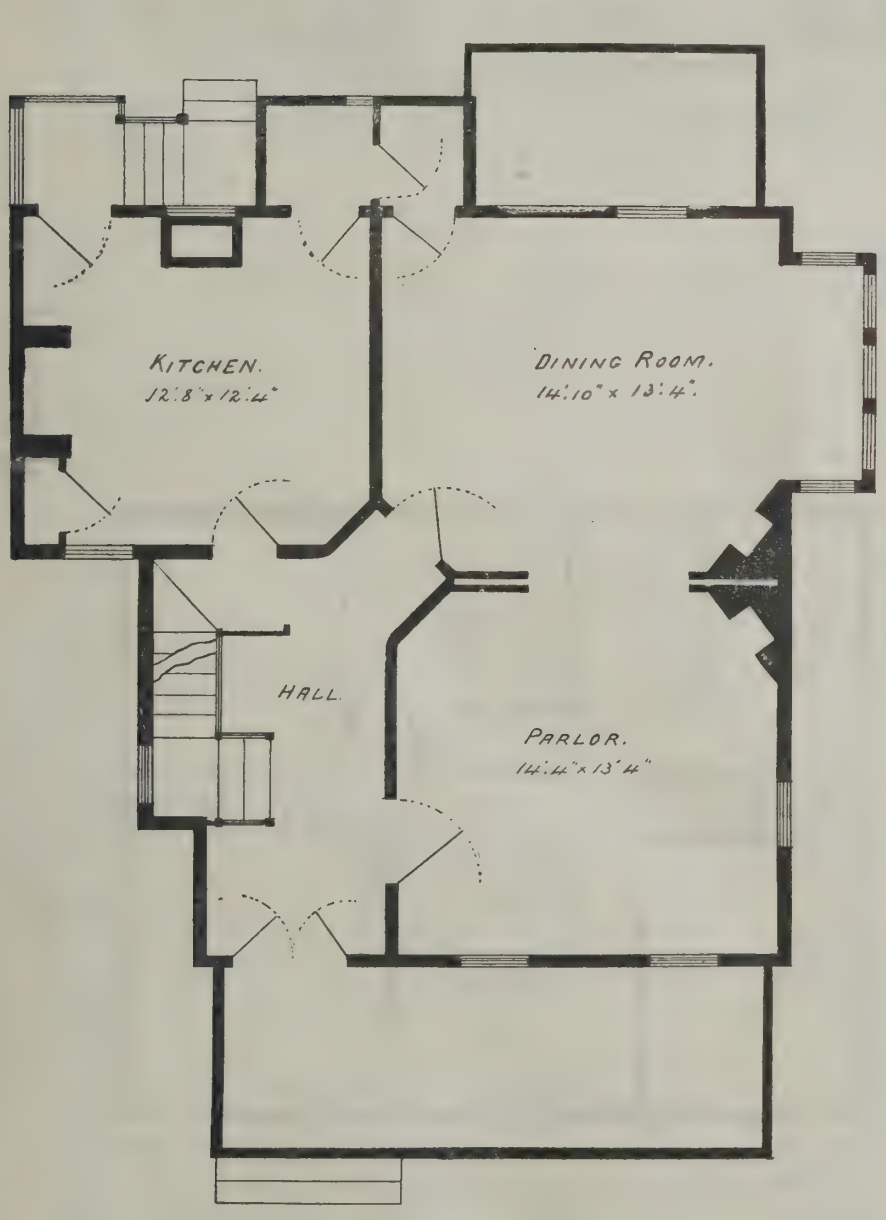
sion bay window, which adds very much to the beauty of the apartment. The chamber, dining room, and parlor have open fireplaces, which make the best ventilation. The house throughout is amply supplied with large pantries and closets. Access from hall to every room except kitchen.

A DWELLING FOR $3,200.

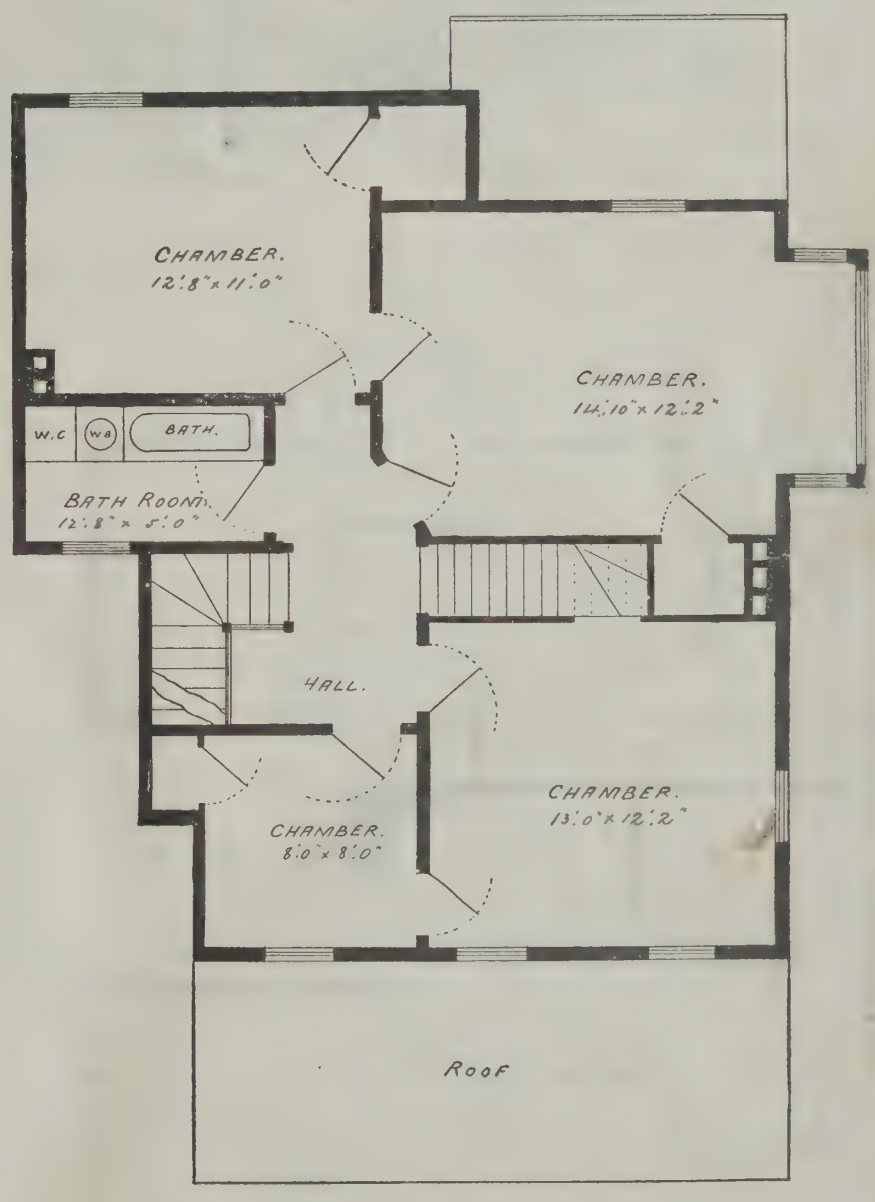
This house has a front of 28 ft. 6 in.; sides, 28 ft., exclusive of bays and piazzas. For size of rooms see floor plans. Height of first story, 9 ft.; second story, 8 ft. 6 in : attic, 8 ft. ; 2 ft. breastwork ; cellar, 7 ft.

Materials.—The entire house is sheathed with rough hemlock boards Sides to plate clapboarded ; gables, shingled ; roof, slate Cost, complete, except mantels and furnace, $3,200

There is an open fireplace in the dining room, also in the parlor. Wide staircase with platform landing. Direct access from hall to all the rooms. Fireplaces built of pressed brick.



FIRST STORY PLAN.



SECOND STORY PLAN.

A DWELLING FOR $3,200.

Decision on a Building Contract.

A curious point of law is reported to us by the kindness of the architects interested. Some time ago these gentlemen were commissioned to draw plans for a skating rink, and a contract was made with a local builder to erect it complete within two months, under forfeiture of one hundred dollars for every day's delay. The building was complete within the appointed time, but with certain defects in the shape of omissions and inferior work, which the architects refused to accept or to certify for. The owners took possession of the building, however, and occupied it for some months, when it was destroyed by fire. The contractor then brought suit for the unpaid balance of the contract price. The case was, by consent of the parties, decided by a referee, Judge Edwards, of Broome Co., New York, who found that no certificate had, as the contract required, been given for the balance claimed ; that the architects, in refusing the certificate, had acted in good faith and without collusion with the owners, and that the condition of the building warranted their refusal ; that the building might have been constructed within the allotted time in substantial conformity with the plans and specifications, but was not so constructed, and that the omissions and defects were material deviations from the contract, and were intentional on the part of the builder ; and he decided that the latter was "not entitled to recover in this action any part of the amount remaining unpaid upon the written contract, being the payment of thirty-one hundred and fifty dollars agreed therein to be paid him by the defendants when the work contracted for was finished and accepted by the architects by their written acceptance."—*Amer. Arch.*

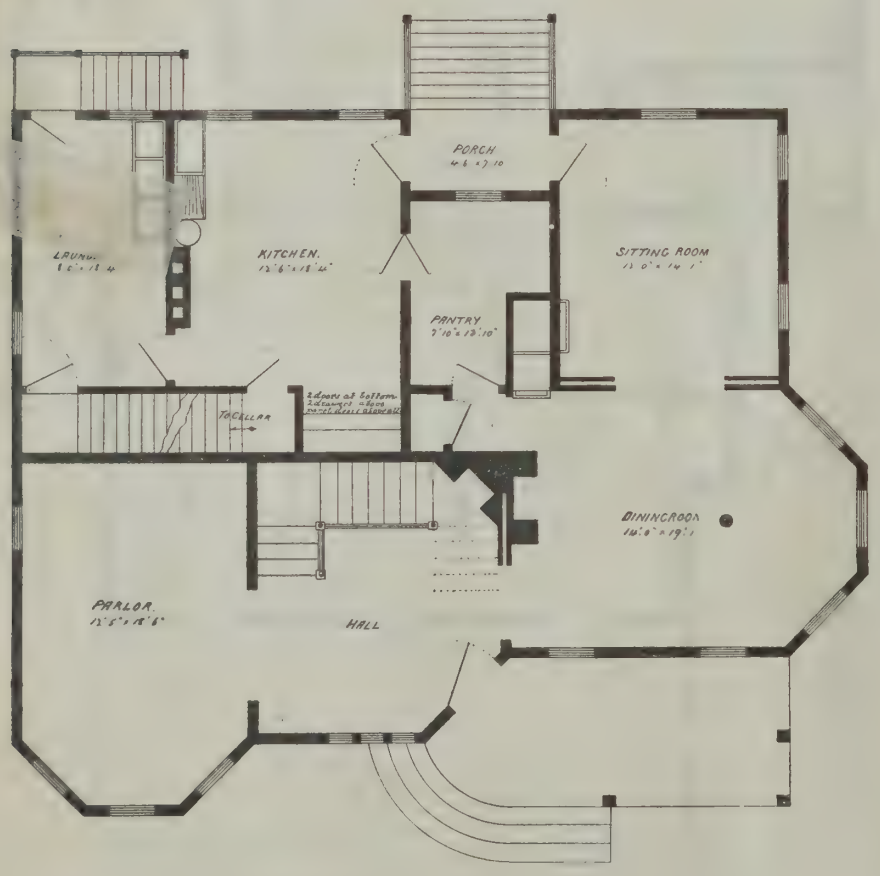
A HOUSE FOR $3,800.

The size is 42 ft. front; sides, 34 ft., not including bay and piazza. For dimensions of rooms see floor plans.

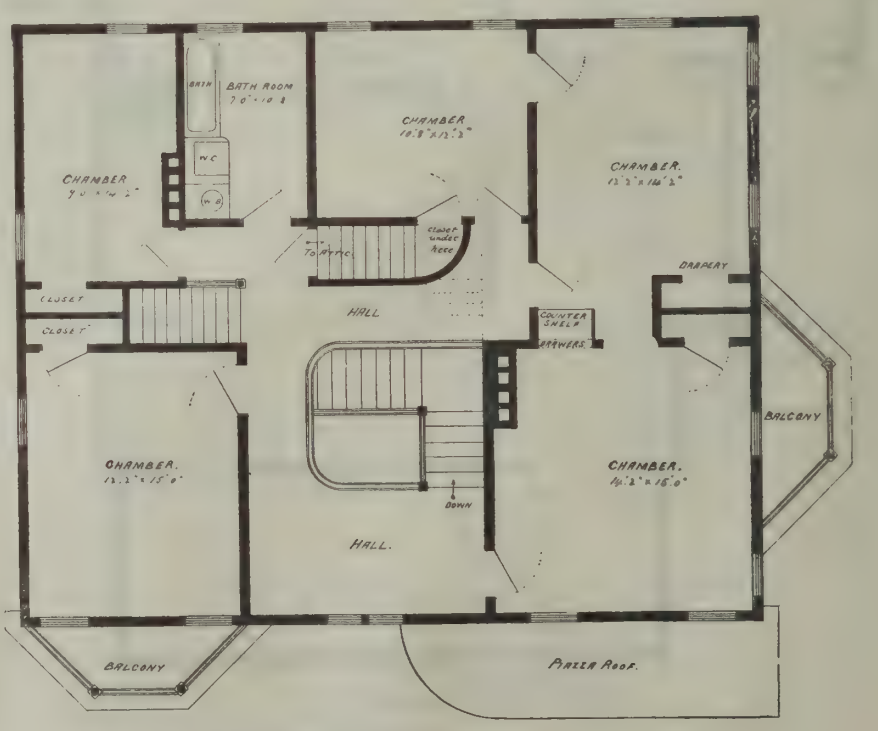
Height of first story, 10 ft.; second story, 9 ft. 6 in.; attic, 8 ft., no breast; cellar, 7 ft.

The Creosoting of Wood.

We had the pleasure a short time ago of inspecting the works of the Lehigh Valley Creosoting Company and the very interesting processes carried on there. They are located on the Lehigh Valley Railroad, at Perth Amboy, on the Kill von Kull, and are controlled by the Lehigh Valley Railroad Company, although they are a separate corporation, and take all the outside work that is offered them. It will be admitted that such an industry for the preservation of the life of wood is a valuable one, and should be encouraged both from economic and practical standpoints. The works consist of a receiving yard, where timber to be creosoted is unloaded, and in which stands a derrick of great reach and power to handle it with, three buildings containing oil tanks, two creosoting cylinders of iron eighty feet long by six feet diameter, housed and with doors in each end, and through which run narrow gauge railway tracks, a pump, engine, and boiler room, containing vacuum, oil, and water pumps, an office building, and a discharging yard supplied with a derrick, where the timber, after being treated, is loaded for shipment. There is also a laboratory, a store room, and a supply room. The derricks are worked by steam winches. With the derrick in the receiving yard the timber to be creosoted is loaded on to small iron cars, which are then run into the cylinder, where the first process takes place. This consists of steaming the



FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

A HOUSE FOR $3,800.

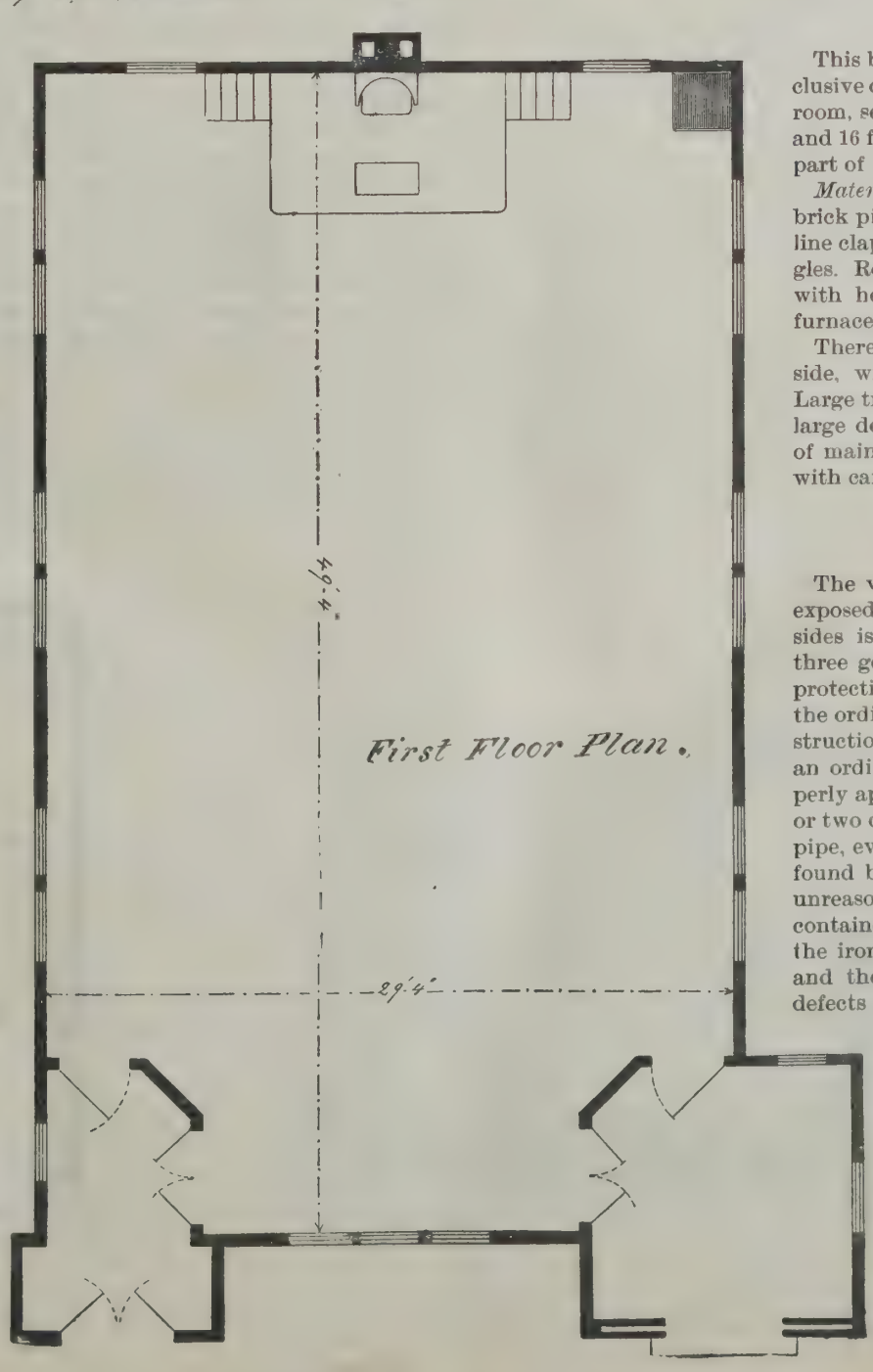
Materials.—The foundation is of stone; sides, clapboards; gables and roofs, shingles Cost, complete, without mantels, range, and heater, $3,800.

There is an open fireplace in hall and dining room. A spacious hall. Hall and three rooms connect by sliding doors or curtains. Back entrance to kitchen and sitting room. Larges pantries and closets conveniently located.

lumber with live steam, the cylinder being hermetically sealed. A vacuum is then created, the cylinders remaining heated by steam coils placed inside. This vacuum causes all the sap and moisture to exude from the opened pores of the wood. This is called the desiccation and preparation of the material. The receipt and absorption of the antiseptic follows

The hot creosote oil (dead oil of tar) is turned into the cylinder and more or less absorbed by the wood, the amount absorbed varying, of course, with the character and age of the wood. After as much of the oil has been taken as will absorb naturally, a pressure rising to 150 lb. is maintained, where a large amount of oil is needed, for a period of hours, until the wood is thoroughly saturated with it, the amount taken varying from 8 to 20 lb per cubic foot of timber. The doors at the other end of the cylinder are then opened and the cars drawn out into the discharging yard, where it is loaded for its destination.

The capacity of the works can be judged by the fact that on the day of our visit four miles of electric conduit had been creosoted. The prime object of the Lehigh Company in erecting these works was to treat the piles for use in their extensive coal docks at Perth Amboy, as those used heretofore have been so rapidly eaten by an insect called the teredo, or marine worm, that they required frequent renewal at large expense. Piles thus treated are unmolested by this creature. Many railway ties have been treated here, and their life is prolonged to such an extent that they wear out mechanically before they decay. The process is of especial value in preserving the exposed timbers of coal dumps, trestle works and docks, telegraph poles, foundation timbers, etc. The works are full of business from all around the country, and are under the able superintendency of Mr. Walter G. Berg, assistant engineer Lehigh Valley Railroad Company.—*Railway Review.*



A CHURCH FOR $3,500.

This building has a front of 30 ft.; sides, 50 ft , exclusive of the hall projections. For size of audience room, see floor plan. The height is 22 ft. in center and 16 ft. on sides. Arched ceiling. Cellar under part of building 7 ft. in the clear.

Materials.—Foundation of stone. Two rows of brick piers in cellar. Sides and ends up to cornice line clapboarded. Gables and tower bands shingles. Roof shingled. The entire building sheathed with hemlock boards. Cost, complete, without furnace, $3,500.

There are wide and liberal entrances on each side, with inner doors on two sides of halls Large triple stained glass window in front. Three large double stained glass windows on each side of main room. The entrances are very artistic, with canopies over doors.

Life of Iron Pipes.

The wear by rust in uncoated cast iron pipes exposed to the action of clean, fresh water on both sides is not more than one-eighth of an inch in three generations. With the present method of protecting such pipes with asphaltum, the life of the ordinary cast iron pipe used in building construction may be greatly prolonged. Indeed, even an ordinary coating of coal tar pitch, when properly applied, is sufficient to add at least a score or two of years to its durability. The life of a soil pipe, even when quite thin and uncoated, has been found by experience to be so great that it is not unreasonable to suppose that the greasy matter contained in sewage serves to coat and protect the iron from the corrosive action of the water and the acid components of the sewage. The defects and leakages more generally met with in such pipes are caused by the defective manner in which the joints are made and improper placing and securing.

Wrought iron pipe for water or gas mains does not seem to have the durability which cast iron possesses. Why this is so, nobody can probably explain. For service pipe, of course wrought iron is preferable, in case lead is not used, but the wrought iron should be galvanized to protect it from corrosion.—*Industrial World.*

Sanitary Arrangements in a Country House.

In an article entitled "My House and How I Built It," published in *Builder and Decorator*, Edw Hurst Brown tells how to fit up a country house with sanitary appliances.

In order to avoid any possible contamination of our water supply, which we obtained from a well, and at the same time not to make it necessary to clean the cesspool as frequently as if all the waste water from the house ran into it, we decided to divide our drainage into two systems. Back in the rear of the lot we dug a cesspool which we lined with a nine inch brick lining, laid in the best Portland cement, and made thoroughly watertight with a plastering of cement and sand. Into this cesspool the terra cotta drain pipe leading from the base of the iron soil pipe from the water closet was carried, which pipe was trapped between the house and the cesspool by a trap which was ventilated to permit a free circulation of air through the pipe, which extended up above the roof of the house, where it was protected from dead leaves by a wire ball such as is put in the top of rain conductors. The cesspool would require to be cleaned every year, when the manhole in the top would be opened and the contents properly disinfected by lime. They would then be pumped out and used as manure.

The second system of drainage was for the roof water and bath and sink wastes. These were all connected, the sink waste first passing through a grease trap or small cesspool, where the grease would rise to the surface, and be ladled out for a fertilizer. In the lowest corner of the ground a large dry well was dug and filled with stones, such as ordinary cobble stones and finer stones, like well screened coarse gravel. Into this pit these latter waste pipes, which delivered clear or slightly soapy water, were carried. The water thus had ample chance to be distributed and soak away into the ground without endangering health or giving any chance for the greasy, soapy ditch so often found near the kitchen of a country house.

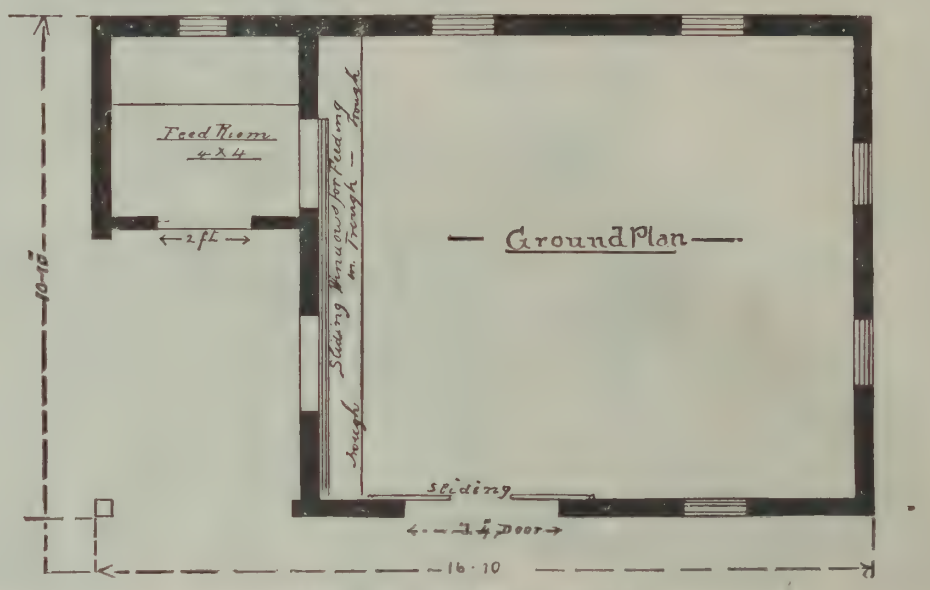
Our water supply was pumped by a hand pump from the well up to the tank located in the attic. From this a tell tale, which was a wooden float with a chain running down and moving a pointer sliding against a graduated rod in the kitchen near the pump, indicated readily, to the person pumping, the amount of water in the tank. In order to prevent a leak and consequent damage to ceilings beneath, the tank was "underlined" with a sheet lead tray, which had a waste pipe running out on the roof, as did likewise the overflow pipe to the tank.

The water closet was of the square top "wash out" pattern, which has neither valves nor internal machinery of any kind, but is made wholly of porcelain, and has constantly standing in the bowl about an inch of water that is washed out by the sudden flow which comes from a cistern placed just above, when the valve regulating the supply is operated by means of a chain handle. The closet we selected was not boxed in by any woodwork, but had a seat hinged to the porcelain itself, so that everything around it could be kept neat and clean, and that there might be no hiding place for dirt or roaches.

In order to keep the water closet free from odor while being used, a ventilating pipe was carried from the bowl to the flue of the kitchen range. The upward current of air in the flue caused a suction in the ventilating pipe which was so strong that the flame of a match held over the water closet would be drawn downward. This insured the air in the room always being kept clean and sweet.

A DEER OR DONKEY HOUSE.

We give a sketch of an ornamental house for a deer, a donkey, goats, or other pet. It may be built for $100 or $150. This design is by Mr. G. W. Cady, of Providence, R. I.



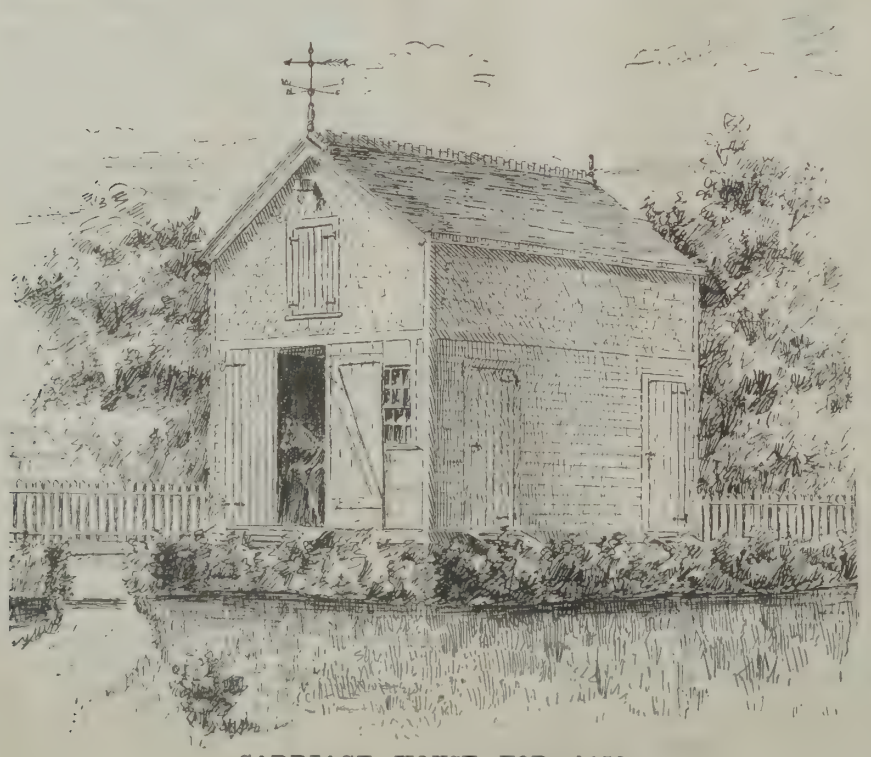
A DEER OR DONKEY HOUSE.

Pinus Parviflora.

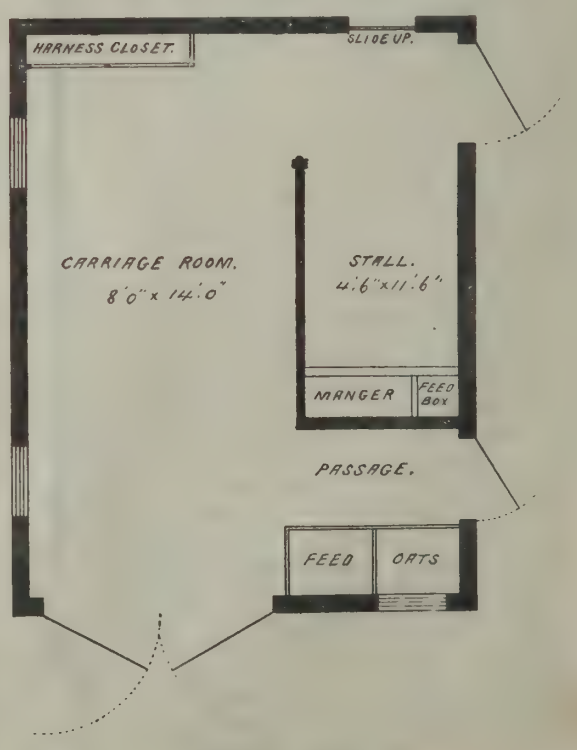
In ornamental planting one often wants a small tree that will not as it grows mar the effect it is intended to produce in association with other trees. The pines, for the most part, are all large-growing trees and cannot be kept within bounds. This little Japanese pine, even in its own country, does not exceed forty feet high, its average height being thirty feet. It is, therefore, just the tree to plant in a position where a large tree would be out of place, and is especially suitable for small lawns, where one desires to have as much variety as possible without taking up too much of the lawn space. It is a beautiful little tree in appearance, most resembling the Swiss stone pine (P. cembra), but not so dark in foliage. Its growth is compact and dense, and assumes a pyramidal outline. The leaves are short, produced in dense clusters, and being twisted give the tree a singular and distinct aspect. The whole tree has a silvery look on account of the glaucousness of the leaves. The cones are oval shaped, from two inches to four inches long and have broad scales inclosing wingless seeds. The tree produces cones in quite a small state, and I saw the other day a pair of fine specimens in Messrs. Bunyard's nursery, at Maidstone, both carrying numerous cones, containing good seeds. I was much impressed with the beauty of these trees at Maidstone, which were growing luxuriantly in sandy loam on a high and exposed part of the nursery. This pine is said to be a great favorite with the Japanese, who cultivate it largely, disfiguring and deforming the trees, as is their custom. It is certainly a pine that should be planted more often than it is, for there is no doubt about its hardiness.—*W. G., in the Garden.*

CARRIAGE HOUSE FOR $150.

Front, 14 ft.; side, 18 ft. For size of floor, arrangement of stall, etc., see floor plan. Height of first story, 8 ft. 6 in. Loft open to roof. Foundation of stone. Single novelty boards. Shingle roof. Cost, $150.



CARRIAGE HOUSE FOR $150.



GROUND PLAN.

THE ARCHITECTURAL LEAGUE.

The third annual exhibition was inaugurated by a private view to the members of the League, and a reception to Richard M. Hunt, on Saturday evening, the 17th ult., at the new galleries of Messrs. Ortgies & Co., Fifth Avenue, near 35th Street.

Last year the exhibition was held in connection with that of the Salmagundi Club, but this year, having found it possible to hold one of their own, it was decided to exhibit not only drawings, studies, and water colors pertaining to architecture, but the allied arts of painting, sculpture, decoration, tapestry, and others were added to make it a brilliant and pronounced success.

All visitors agree that in the many and varied attractions, the grouping of the drawings, the character of the work shown, and the vast array of beautiful things displayed in the loan collection, it is the finest exhibition of architectural art ever seen in this country.

The reception was a brilliant social event, there being present many people belonging to some of the best known families in New York.

The exhibits occupied three rooms of the galleries, the entrance hall being devoted, on the left, to what was possibly the most attractive drawings of all, viz., the water color external facade and the court, in black and white, of the Hotel Ponce de Leon, at St. Augustine, designed by Carrere & Hastings, of New York. The quaint old Spanish building, with Moorish effects, excited the admiration of every architect and artist present.

The coloring of the walls is that of a light blue gray, relieved by terra cotta friezes, panels, and ornaments of a light salmon color, and the whole crowned by deep red Spanish tiles.

It is generally admitted that when completed it will be the finest hotel building, from an architectural point of view, in the United States. We give some illustrations in this number of our paper.

Above these was a block of New York houses by Mr. Mott, in good taste and varied in design. On the right were grouped the forty-three competitive designs for a memorial clock and bell tower. All the drawings were signed either by motto or in cipher.

It must be admitted that the first impression of the designs was one of disappointment, but a second and a closer look revealed the fact that many of the designs, simply as drawings, were beautifully rendered. The free, masterly touches here and there, the clear outlines and skillful shading, induced one to look for more than was to be seen.

The general impression was that the competitors did not fully comprehend what was asked of them. Although but one of the competitors was excluded for not complying with the technical requirements, it is evident that none of them complied with, or was in sympathy with, the *motif* of the competition.

The general idea seemed to be that something quaint and picturesque, and perhaps antique, was wanted, so many of the designs had a feeling for the French renaissance, and one of the designs that received an honorable mention showed evidence of such studies as that of the Chateau de Chenonceaux, De Blois, and other chateaux, and it can be readily imagined the effect was not altogether happy.

A general forgetfulness of the traditional surroundings of a village green seemed to prevail, the atmosphere of narrow streets and high buildings evidently had taken everlasting possession of these young men; for instance, the towers were, in every instance but two, possibly too high, some of them four and five stories high, with frowning battlements and a bewildering array of miniature towers and pinnacles; and we are inclined to think that the general tendency to run into the clouds induced the committee on the medals to award the gold medal to the lowest design exhibited.

It consisted of a low square tower supported at the base by four piers, from which sprang four huge arches, the voussoirs being in dressed masonry, the walls having a bold batter and built of rough, uncoursed rubble. The stone work is capped by an open work belfry, whose roof is supported by square timber posts, low pitched and covered with red tiles. The clock is of wrought iron dial and hands, and of such inharmonious proportions as to excite general condemnation.

We cannot agree with one critic, however, who says, "We here get the feeling of brute masses of money." The remark was made, evidently, by one who is entirely unacquainted with the cost of building material, for the rough, uncoursed rubble is often much cheaper than bricks, and the whole design is so simple in its parts that it could be constructed for a very small sum of money.

The appropriate part of the design is the low elevation of the tower, in keeping with the elevations usually seen in a rural town or village, the plain, unpretending character of the materials used, and the bit of color in the roof tiles. The objectionable features are the unnecessary heaviness of the arches, the heavy batter of the walls, and the inordinate size of the clock, but notwitstanding these objections, it is clearly the best design submitted. The second prize is a pen and ink drawing of a tower in brick and stone, modeled after such *manoires* as that of Vourgour, Bures, Londonieres, Lisieux and others. The bold brackets supporting a small balcony are somewhat staring, and the roof has a slight concavity that gives it a quaint effect that in some respects is not pleasing, but the drawing is beautifully rendered and it also is low and suitable.

The design marked "Mephistopheles" is one that received honorable mention. It is a deep red stone tower modeled somewhat after the towers of Lombardy. It is surmounted by a double arch containing two bells, both under one roof, behind it an open turret or terrace. In many respects the most picturesque drawing exhibited; but its height is overpowering. Imagine a sixty foot tower on a village green!

It would be interesting and profitable, not only to the forty-three competitors, but to the many draughtsmen and architectural students of this journal, if a replica of them all could be published, so as to be studied and examined by comparison and contrast. In this respect the exhibition is in every way superior to the one held last year.

Of interest to all lovers of fine pen and brush and ink work are the superb series of sketches of the cathedrals of England, by Joseph Pennel, kindly loaned by the Century Co. The originals must certainly affect the engravers with despair. In the shading of the columns in the choir of Ely the brush work is exquisite, the deep shadows toning inperceptibly into the lighter grays, and the original surface of the paper is left here and there to express the high lights, but it is a skillful hand that has guided the brush, and it is to be regretted that our city has no permanent collection of black and white drawings such as these that can be visited and studied at one's convenience.

Of public buildings a few are shown, notably the New York Life Insurance building at Montreal by Messrs. Babb, Cook & Willard; a competitive drawing, but not the accepted design, for the Carnegie library at Allegheny, Pa., by J. L. Faxon; and Rotch & Tilden's art museum for Wellesley College and A. Page Brown's excellent design for the art museum of Princeton University, the former severely classical and the latter warm, rich, and modern.

The only bonifacial building is that of Mr. Pickering's Orange Heights Hotel, striking for its bold wall exposure on the face of the bluff and the broad rectangular tower, which, in truth, looks more like a Norman keep than a modern building. It is to be built in the spring.

The end of the main gallery is graced by a series of drawings and studies done by Mr. Hunt while studying architecture in the Ecole des Beaux Arts. The principal one is a group of studies of details for the Pavilion de la Bibliotheque of the Louvre.

Perhaps the most interesting drawings to the readers of the BUILDERS EDITION, aside from the clock tower competition, are the many designs of country houses. Two particularly of Rossiter & Wright's were especially attractive, the features being the broad, low eaves, without cutting up the second story into useless rooms, and the slender, graceful chimneys. The most interesting villa was that of Stone Acre, at Newport, done in water color, by Bruce Price.

The loan collection exhibits plaster reliefs, by Augustus St. Gaudens, of Dr. Bellows and the Schiff children, panels by L. Jac-Gallaud, decorative oils by Walter Shirlaw, reproductions of Della Robbia's work, water colors by John La Farge, including some of his Japanese views, designs by Dora Wheeler, and the original drawings of W. H. Low's series in illustration of Keats' odes and sonnets.

The gold medal for the best drawing of a memorial clock and bell tower was awarded to James A. McLeod, of Minneapolis, Minn. Silver medal to W. B. Mundie, of Chicago, Ill. Honorably mentioned: Julius Harder, New York City; William C. Noland, Philadelphia, Pa.; and Timothy F. Walsh, Cambridge, Mass.

We give in our present number several engravings illustrative of some of the League exhibits, namely:

Hotel Ponce de Leon, elevation.
Hotel Ponce de Leon, main entrance.
Hotel Ponce de Leon, ladies' entrance.
Hotel Ponce de Leon, grand dining room.
The Alcazar.
Tower of St. Augustine Church.
Sketch for a Town Hall.
Sketch for a Tower.
A Country Residence.

K.

A MARBLE tablet recently found in an ancient sepulcher on the Via Portuensis, Rome, is apparently a work of the first century. It represents a naked youth, with long, disheveled hair, defending himself against two women, one facing him and the other attacking him from behind. The women brandish thyrsi resembling lances in one hand, and a serpent winds itself around the other arm of each, and they seem as if about to sling them at the face of the youth. Archæologists are puzzled to know what it is all about, but guess it represents the death of Pentheus, who was torn in pieces by Mænads on Mount Cithæron for having reviled the Bacchic mysteries.

Spots upon Plaster Ceilings.

I was called to inspect a building lately erected and to find the cause of discoloration of the ceilings. Particularly upon the ground floor there were constantly to be seen brown spots, and these were intensified in damp weather, and at the same time other spots would appear, which faded away as dry days returned. A few isolated spots could be found in other parts of the building, but most of them were concentrated in the one lower chamber. The building is constructed with floors of flat terra cotta arches, the ceilings plastered directly upon them, and there is a layer of several inches of cement concrete above the terra cotta work, and upon which the board floors are laid.

A careful survey of the ventilation flues, to trace possible leakage, failed to establish any relation with the spots. They were equally in the center of the ceiling of the lower room and at the sides. In one case, a single spot was found in the entry of an upper story. The tiling above this one spot was removed, also the concrete, but there was no sign of any unusual condition, everything was dry, there was no disintegration of the cement, nor was the upper surface of the exposed terra cotta block discolored. Evidently some local cause in the plastering or coloring was to be sought.

To this end I took a number of samples from a ceiling of both plastering and kalsomine in spotted places, and the same from clear portions adjoining. The plasterer who had done the work informed me that only the common lime and sand plaster had been used, and no hard coat had been put on. The kalsomine had been applied directly to the second coat. This kalsomine was the ordinary one of Paris white, chrome yellow, and umber, with a glue size—a yellow tone of brown. It had been worked on soon after the plaster was well dried.

Microscopic examination of the samples showed no cause for the stains. The deeper colored kalsomine of the spots looked like the addition of more umber, though no greater proportion was really present. A chemical analysis of the plaster, however, furnished a clew.

	Lime, per cent.	Sand, per cent.
A light brown spot gave	62	38
A dark brown spot gave	70	30
A clear portion neighboring gave	51	49

Thus it appears that where the lime was in excess of the normal proportion between it and sand, the spots occurred, and the spots deepened in color with greater proportion of lime.

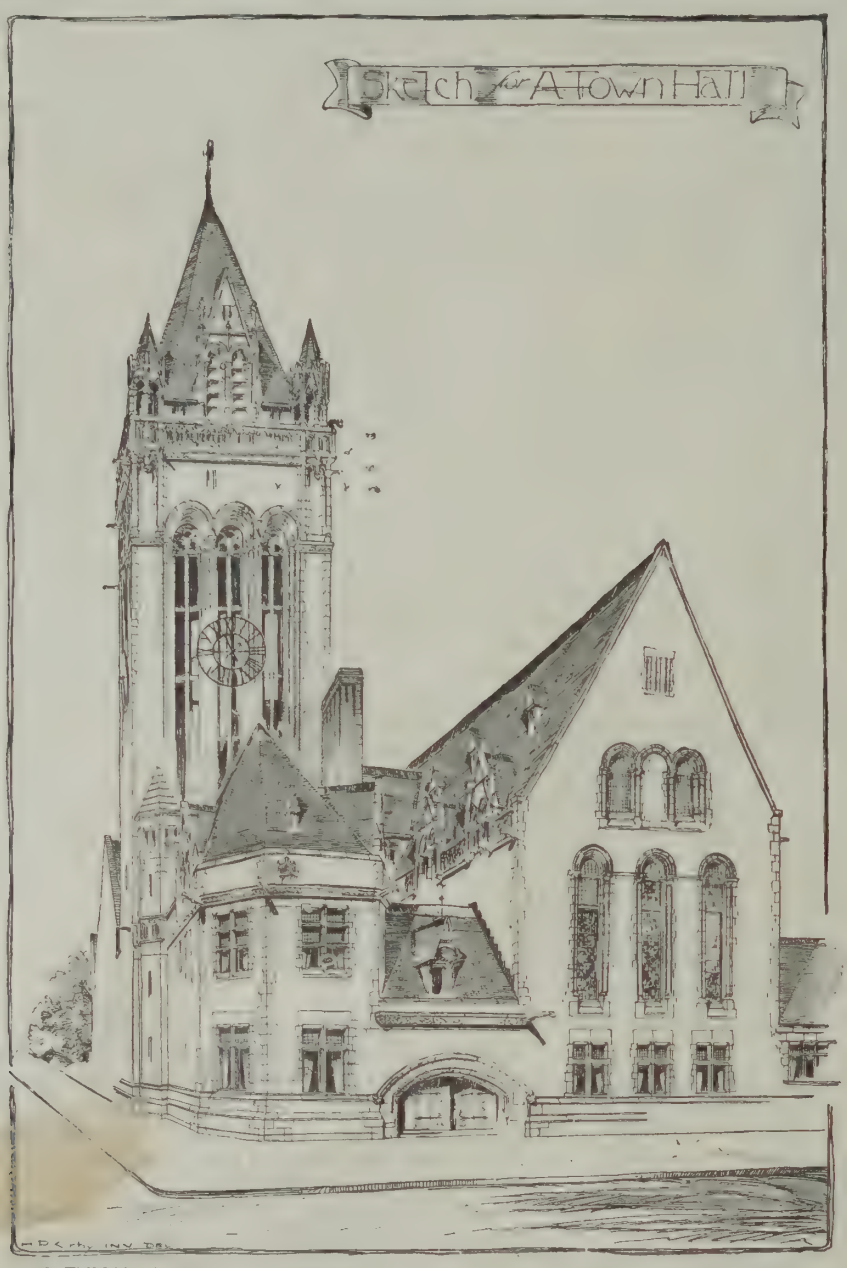
In pursuit of this idea, I sent a block of the terra cotta similar to those used in the building to the plasterer, requesting him to put upon it two coats, as he had done in the work. Some kalsomine was sent me made as was that used in the building. Before applying it, I located some lime spots free from sand upon the plaster. To duplicate as nearly as possible the damp condition of the floors from the effects of the undried concrete, I filled the ducts of the terra cotta block with damp sawdust and maintained it so. In a few days there appeared on the kalsomine surface brown spots, the counterparts of those in the building, wherever the lime spots in the underlaying plaster occurred.

The reason of the formation of all the spots was undoubtedly the same: Small lumps of partially slaked lime had acted upon the iron oxide (umber) of the kalsomine, and its color had been increased by the causticity of the lime, which, as it became further slaked by the moisture drawn through the porous terra cotta from the concrete above, spread out the deepened color into a considerable spot. Probably one or two barrels of the lime used were not as well burned as usual, and, in tempering the plaster, small lumps of half-slaked lime escaped notice. In spreading this upon the ceilings, the trowel broke down such lumps, and they were partially mixed with the sand of the plaster in which they lay, but not enough to prevent analysis from showing a notable deficiency of sand and consequent good mixture of wet plaster, or enough to thoroughly slake the lime lumps. These lime spots are exceedingly persistent when fed by moisture from a concrete above, and once they appear, no ordinary work, like additional washes of color, or even a coat of oil paint, will obliterate them.

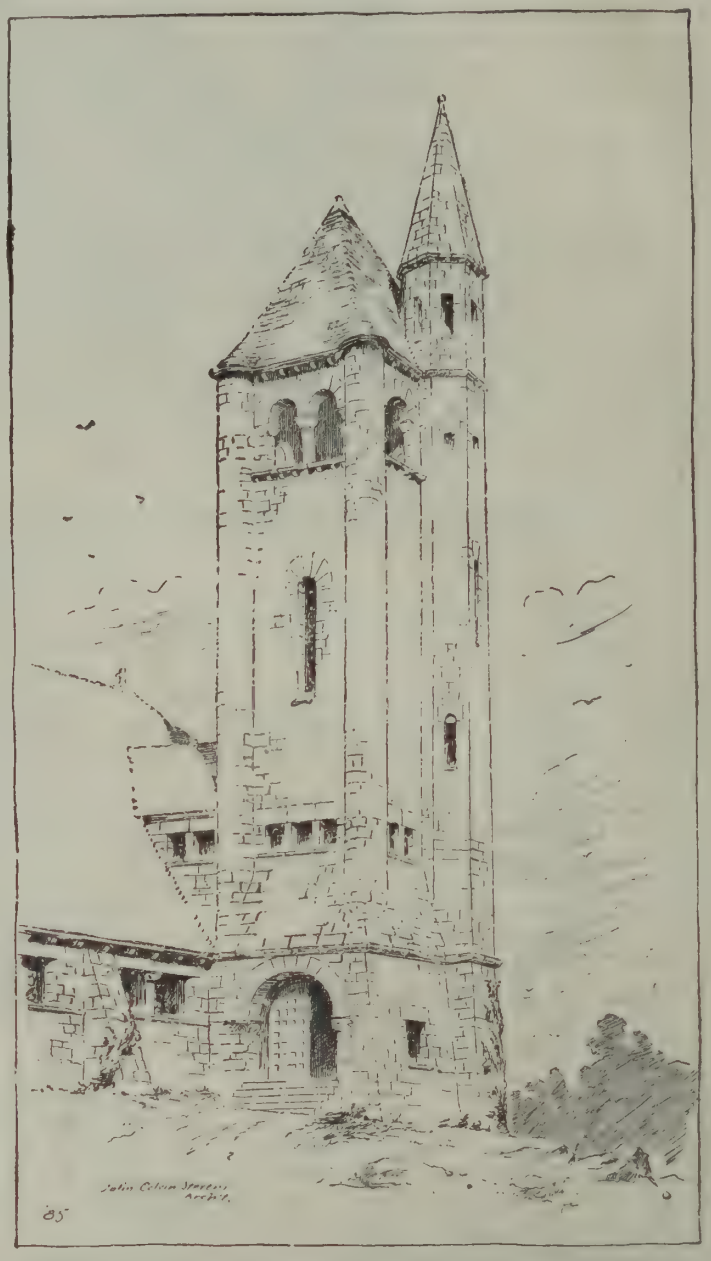
Two ways of obviating such occurrences suggest themselves. Presuming that lime plaster may not always be perfectly tempered, it would be well to postpone the kalsomining as long as possible, or, if this is not practicable, the safe course is to apply a hard coat (plaster of Paris) before kalsomining. Where the expense of a hard coat must be saved, the sure way to avoid spotting is to use only the best prompt slaking lime for the plaster work, leave it piled as long as may be, and double temper it. Then there is fair reason to expect a good result. The thick layer of concrete used in construction of this kind dries much more slowly than the plaster, and furnishes moisture to it for so long a time that it is indispensable for good work to have the plastering in perfect condition if the ceilings are to be kalsomined at once they appear to be dry.—*Charles Tennant Lee, American Architect.*

Straight and Curved Lines in Architecture.

It is only by a combination of several notes that harmony is produced, and gentle or brilliant melodies by their fading into one another, or by strongly marked contrasts. So it is with forms: the square and angular are expressive of strength and power, curves of softness and elegance, and beauty is produced by effective combination of the right-lined with the curvilinear. It is always thus in nature. Rocks and all the harder substances are rough and angular, and marked by strong contrasts and deep lines. Even among trees the oak is rugged, and its branches are at right angles to its stem or to one another. The lines of the willow are rounded and flowing. The forms of children and women are round and full, and free from violent contrasts; those of men are abrupt, hard, and angular in proportion to the vigor and strength of their frame. In consequence of these properties, as a general rule, the square parts ought always to be placed below, where strength is wanted, and the rounded above. If, for instance, a tower is to be built, the lower story should not only be square, but should be marked by buttresses or other strong lines, and the masonry rusticated, so as to convey even a greater appearance of strength. Above this, if the square form is still retained, it may be with more elegance and less accentuation. The form may then change to an octagon, that to a polygon of sixteen sides, and then be surmounted by a circular form of any sort. These conditions are not absolute, but the reverse arrangement would be manifestly absurd. A tower with a circular base and a square upper story is what almost no art could render tolerable, while the other pleases by its innate fitness without any extraordinary effort of design. On the other hand, round pillars are more pleasing as supports for a square architrave, not so much from any inherent fitness for the purpose as from the effect of contrast, and flat friezes preferable to curved ones of the late Roman styles, from the same cause. The angular mouldings introduced among the circular shafts of a Gothic coupled pillar add immensely to the brilliancy of effect. Where everything is square and rugged, as in a Druidical trilithon, the effect may be sublime, but it cannot be elegant; where everything is rounded, as in the Choragic monument of Lysicrates, the perfection of elegance may be attained, but never sublimity. Perfection, as usual, lies between these extremes.—*J. Fergusson.*



SKETCH FOR A TOWN HALL—H. P. KIRBY, ARCHITECT.



TOWER BY JOHN CALVIN STEVENS, ARCHITECT.

The Murphy System.

In a recent job of plumbing done by Henry Hussey & Co., the Boston plumbers, the piping is placed and run to comply with the requirements laid down in the new system of house drainage designed by Richard Murphy, of Cincinnati, and exhibited at the last meeting of the National Association of Master Plumbers.

The writer recently had occasion to examine a system built as Mr. Murphy recommends.

The system examined is placed upon a remodeled house drainage system which was in the building occupied by Murphy & Atkinson as their business premises, at 134 Sycamore Street, Cincinnati. The soil pipe originally extended through the roof, and made its horizontal turn in the shop room. On the lateral run of the soil pipe, against the shop wall, Mr. Murphy placed a running trap. From the lateral soil pipe on the upper side of the trap, he extended a four inch pipe, running, in this case, alongside the soil pipe and subject to the same temperatures, until it makes its exit above the roof, using for its upper portion that part of the old soil pipe which was cut off, so as to make it end in the attic. In this method of construction economy was, perhaps, as much an object as convenience, and as it was to be an experimental plant, it is presumed that Mr. Murphy did not care how many eighth bends were put in the vent pipe, as the more difficulties with which he surrounded it, the greater would be success, if success was attained. In the vent pipe, about five feet above the point where it leaves the soil pipe, Mr. Murphy has left a two inch observation hole, open at all times. Repeated tests with a candle flame showed the air to be moving rapidly within the system, and that the flushing of sinks or closets increased the rate of movement. Mr. Murphy stated that in repeated tests he had never seen the air coming out of the top end of the soil pipe in the attic, but it was always down.

The practical working of Mr. Murphy's plan seems entirely satisfactory, even though sanitarians, on general principles, would condemn leaving an open soil pipe in the house. The plumbers in convention objected to this. Mr. Murphy states that it works equally as well if both soil and vent pipe are carried above the roof, provided the vent pipe is carried higher than the soil pipe. In good construction, however, he advises the cast iron vent pipe to be carried up the heated kitchen chimney flue, to insure a higher temperature than that to which the soil pipe is subjected. —*Sanitary News.*

A COUNTRY RESIDENCE—JOHN CALVIN STEVENS, ARCHITECT.

PRIVATE RESIDENCE OF M. GREVY, EX-PRESIDENT OF FRANCE.

M. Grevy's hotel is situated on the Avenue d'Jena, at the junction of Rue de Magdebourg and Rue Fresnel, in the *quartier* Trocadero. It has two facades, one on the avenue and the other one, with a garden, on the Rue de Magdebourg, and is of rather monumental appearance. The late Mr. Brune, architect of the department of commerce and professor of architecture in the Ecole des Beaux Arts, made the designs and directed the construction of the building. With the grounds, this house has not cost less than about $800,000. The interior decorations, which have not yet been finished, will be very elegant.—*Paris Illustre.*

Painting Iron Work.

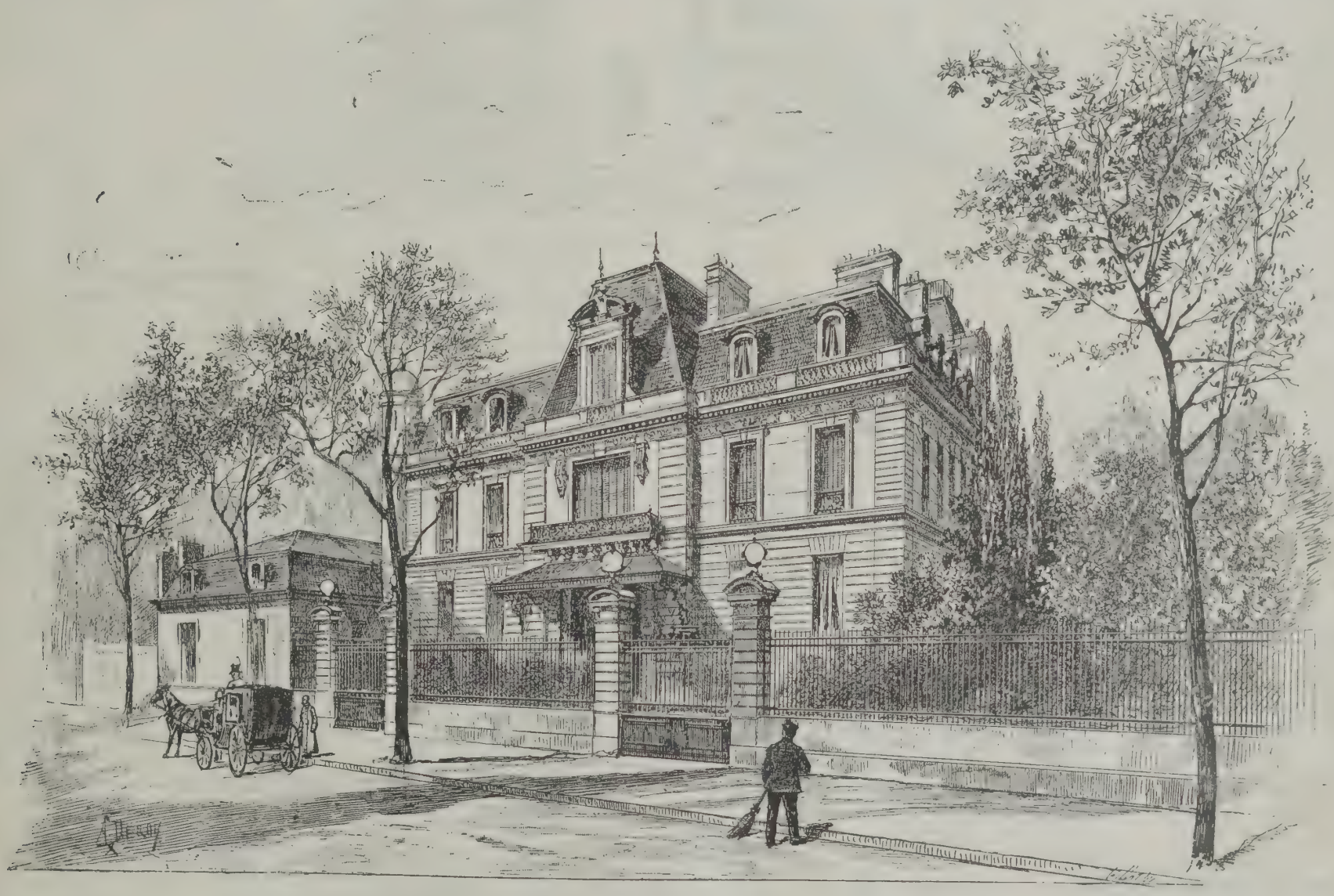
Cast and wrought iron behave very differently under atmospheric influences, and require somewhat different treatment. The decay of iron becomes very marked in certain situations, and weakens the metal in direct proportion to the depth to which it has penetrated; and although where the metal is in quantity this is not very appreciable, it really becomes so when the metal is under three-quarters of an inch in thickness. The natural surface of cast iron is very much harder than the interior, occasioned by its becoming chilled or by its containing a large quantity of silica, and affords an excellent natural protection, but, should this surface be broken, rust attacks the metal and soon destroys it. It is very desirable that the casting be protected as soon after it leaves the mould as possible, and a priming coat of paint should be applied for this purpose; the other coats thought requisite can be given at leisure.

In considering the painting of wrought iron, it must be noticed that when iron is oxidized by contact with the atmosphere, two or three distinct layers of scale form on the surface, which, unlike the skin upon the cast iron, can be readily detached by bending or hammering the metal. It will be seen that the iron has a tendency to rust from the moment it leaves the hammer or rolls, and the scale above described must come away. One of the plans to preserve iron has been to coat it with paint when still hot at the mill; and although this answers for a while, it is a very troublesome method, which iron masters cannot be persuaded to adopt, and the subsequent cutting processes to which it is submitted leave many parts of the iron bare. Besides, a good deal of the scale remains, and until this has fallen off or been removed, any painting over it will be of little value.

The only effectual way of preparing wrought iron is to effect a thorough and chemical cleansing of the surface of the metal upon which the paint is to be applied; that is, it must be immersed for three or four hours in water containing from one to two per cent. of sulphuric acid. The metal is afterward rinsed in cold water, and, if necessary, scoured with sand, put again into the pickle, and then well rinsed. If it is desired to keep iron already cleansed for a short time before painting, it is necessary to preserve it in a bath rendered alkaline by caustic lime, potash, soda, or their carbonates. Treatment with caustic lime water is, however, the cheapest and most easy method, and iron which has remained in it some hours will not rust by a slight exposure to a damp atmosphere.

Having obtained a clean surface, the question arises: What paint should be used upon iron? Bituminous paints, as well as those containing variable quantities of lead, were formerly considered as solely available, but their failure was made apparent when the structures to which they were applied happened to be of magnitude, subjected to great inclemency of weather or to constant vibration. Recourse has, therefore, been had to iron oxide itself, and with satisfactory results. A pound of iron oxide paint, when mixed ready for use, in the proportions of two-thirds oxide to one-third linseed oil, with careful work should cover twenty-one square yards of sheet iron, which is more than is obtained with lead compound.

Oxide of iron paint endures a very great heat without material alteration, and keeps both its color and preservative qualities well. There is this difference to be noticed between painting of iron and wood—that with the former, when the painter comes to spots of rust that cannot be removed, he should endeavor to incorporate them with the paint rather than paint over them The repainting of iron involves carefully washing down and removing all dust, dirt, and so on from the entire surface, every particle of rust being scraped and chipped off, the work receiving from two to four coats in oil properly applied. The real value of any paint depends on the quality of the linseed oil, the quality and character of the pigment, and the care bestowed on grinding and mixing, and as all this is entirely a matter of expense, cheap paints are not to be relied upon.—*London Carpenter and Builder.*



PRIVATE RESIDENCE OF M. GREVY, EX-PRESIDENT OF FRANCE.

Utility and Beauty in Architecture.

Architecture may be defined as a compound art, the offspring of utility and of pleasure; and, as such, it ought at once to serve and to please us, by the union of those forms which are the most suitable to the exterior wants of man and those which bear the greatest affinity to mental and intellectual pleasures. This definition, while it embraces the universality of the uses of architecture, and indicates its twofold principle, likewise shows us the difficulties which the art presents. Obliged to serve us in pleasing us, and to please in serving us, we see that it is impossible for the natural, technical, moral, or poetical parts of the science to be widely separated But what affinity, it may be asked, is there between the forms required by utility in architecture and the forms whence result the ideas of order and beauty? What analogy is there in the exactions of utility, as regards walls, pillars, and roofs, with the proportions, arrangements, and ornaments which constitute harmony and beauty? We agree that ideas of order, symmetry, and concord have their origin in the constitution of our minds, but their application to the art of building is so far from being a necessary consequence of the exercise of that art, that no people but the Greeks have ever carried its application to the point of perfection.

Such was the strict connection between the useful and the beautiful among the Greeks that, if we consider their architecture in the useful point of view, it appears to bear the stamp of utility so evidently that it might be believed the Grecian architects never had pleasure for an object; and if we examine it with respect to beauty, we might be tempted to think that they never took into consideration the laws of necessity and utility. We must own that this happy alliance might never have been formed elsewhere; so rare must be this equal combination of the elements of utility and pleasure, whether in the works of men or in the organs and qualifications of their authors. It was this latter concord that gave birth to the art of architecture in Greece. From the disunion of these two elements (utility and beauty) sprang more or less alterations in the principles and taste of architects. Causes of which we cannot here give an account gave the superiority to the ornamental or decorative department, and the system of order and the fundamental sense of utility, upon which ought to repose all the rules of art, were comparatively neglected. Reason was sacrificed to prejudice. Architects, charmed with the beautiful forms of antiquity, adopted them without considering how they were to be applied, and thus the exquisite concord produced by the union of utility and beauty was destroyed, and the art proportionately debased. Every art ought to have rules, which, without restraining genius, preserve the bounds within which it may be freely exercised; but it should never be forgotten that, unless these rules have a more solid foundation than one based on arbitrary examples and authorities, whether of ancient masters or of a blind routine, and, in short, unless they rest upon a perfect accord between pleasure and utility, their inefficacy ought to bring them into discredit.—*Quatremere De Quincy.*

THE British Admiralty are, it is said, considering the advisability of adopting the suggestion recently made by Commander Charles Campbell, to the effect that two fast-going colliers should be attached to the chief sea-going fleets, each collier capable of carrying at least 3,000 tons of coal. One of them would always be on duty with the fleet, while the other would proceed to the nearest coaling station for filling up.

A RESIDENCE IN MINNEAPOLIS.

We give a sketch of comfortable dwelling erected in Minneapolis. Mr. Frank E. Read, architect, of same place. We are indebted to the *Northwestern Architect* for our engraving.

Railroad Snow Sheds.

Snow sheds to cover the railway track have been built at points on the Central Pacific road where it crosses the Sierra. As the trains bound East leave Emigrant Gap they run through one continuous shed for 35 miles. The purpose of the sheds is to prevent the track being buried under falling and drifting snow. They secure this end, but are themselves the occasion of great inconvenience, such as the noise, the loss of view, and confining of the smoke to the train. There is nothing peculiar in the construction of these sheds, which have to support only the burden of the snow. But on the line of the Canadian Pacific, where the road crosses the Rocky Mountains, sheds of a different construction are needed. Before the road was completed, observations in the mountains showed that avalanches must be provided against. A single avalanche covered the track for a distance of 1,300 feet and to a depth of 50 feet. The result of these observations was that the company built 4½ miles of snow sheds, at an enormous expense. The sheds are constructed as follows: On the high side of the mountain slope a crib filled with stones is constructed. Along the entire length of the shed and on the opposite side of the track a timber trestle is erected; strong timber beams are laid from the top of the crib work to the top of the trestle, four feet apart, and at an angle representing the slope of the mountain as nearly as possible. These are covered over with four-inch planking, and the beams are braced on either side from the trestle and from the crib. The covering is placed at such a height as to give 21 feet headway from the under side of the beam to the center of the track. The longest of these sheds is 3,700 feet.—*Truckee (Nev.) Republican.*

A RESIDENCE IN MINNEAPOLIS.

A DWELLING OF SMALL COST.

In the accompanying plans and elevation of a small but comfortable home we had, primarily, in view the expenditure of but a small sum of money, and in view of this fact the rooms have been kept to a size convenient for the purposes marked on each. The out side finish, also, while presenting an attractive appearance, has but few, if any, embellishments that can be dispensed with. The addition of the front porch adds much to the beauty and utility of the design, and yet the expense of the same is but trifling. We present a few suggestions to those who are interested in the plans given.

A well lighted and ventilated basement is always to be desired in a country home, as it prevents the articles kept therein from being affected by either heat or cold. (We are now writing in California, where very cold weather is never experienced.) A farmer or mechanic can construct his own basement at but little expense. There are but few places where rock cannot be conveniently had. During the spare time, haul enough of this material to the building site. With the aid of one mason, you will soon have a basement that will bid defiance to the storms. Calculations can be made so that the dirt excavated can be placed on the four sides of the house, sloping gradually from the walls outward, so as to insure proper drainage. If the cellar is to be used at times as a work shop, it would be well to place more windows on the side for light; but those shown will be found sufficient for all ordinary purposes.

The walls of basement being finished, see that the wall plate is well bedded, and as near level as possible. This is important, as it saves much time hereafter. After the joists are placed in position, fill up the spaces between them with rock, so that rats and mice will not be able to get a foothold. This is also an important fact. Cut your flooring, and turn it upside down. Do not nail it until house is all inclosed. By this means the workmen have a substantial place to work on, and, better still, the lumber has a splendid chance to thoroughly dry and shrink. Do not rest your plates on the joist. Nail thoroughly a piece of flooring first on top of the joist, and let your plates rest on that. This prevents the unpleasantness, common to so many houses, of a draught from under the base board. These suggestions may look simple, but they serve, if carried out, to make a home truly comfortable to live in.

Do not spare the braces. They cost but little. Have them well nailed. Then when the storms come, as you sit in your dainty parlor, what a pleasant sense of satisfaction you have to feel that no storm can shake your little abode, for it is well nailed together, well braced, and founded upon a rock.

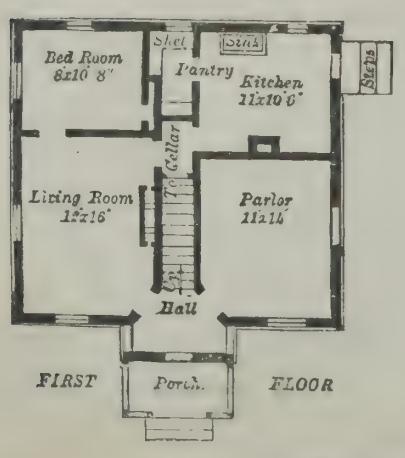
Two more essentials of the building must receive careful attention. See that your chimneys are well built. Do not let a single joint pass your observation. Have the inside well and smoothly plastered. Take no chances on "*That will do.*" It will *not* do to have your house catch fire from a defective flue simply because you wanted to save an hour's time and a bucket of mort r Notice carefully the shingling of your roof. Do not let the workman fool you by saying one nail in two shingles is good enough; that is all nonsense. Shingles must be well nailed, as much so as the flooring. Look out for the flashing around the chimney. No leak is wanted there, and a little care will effectually prevent the same.

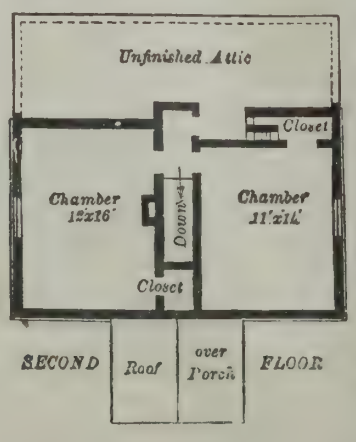
The plans are very legibly marked as to the size and character of the rooms. Any mechanic can erect the house shown by the designs given. We hesitate to give the cost of the house. Lumber in this city has increased from $15 a little over a year ago to $25 at present time. Wages are higher. All necessary materials are higher. But for a general average, we may say that the building will cost anywhere from $1,200 to $1,600, depending altogether on the location.

The unfinished attic will be found a convenient receptacle for the storage of trunks, etc. By increasing the height of the stories a little, this part can be utilized for sleeping room in case of necessity. —*Cal. Architect.*

FRONT ELEVATION

SIDE ELEVATION





A DWELLING OF SMALL COST.

Frost Glass.

The late Mr. Gibson, of Broadway and 13th Street, New York, was the originator of the above mode of ornamenting glass. It was practiced by him some fifteen years ago. The varnish referred to consists of glue.

A new sort of ornamental glass is now made in Paris by M. Bay, which he calls by the name of hoar frost glass, *verre givré*, from the pattern upon it, which resembles the feathery forms traced by frost on the inside of windows in cold weather. The process of making the glass is simple. The surface is first ground either by the sand blast or the ordinary method, and is then covered with a sort of varnish. On being dried, either in the sun or by artificial heat, the varnish contracts strongly, taking with it the particles of glass to which it adheres; and, as the contraction takes place along definite lines, the pattern produced by the removal of the particles of glass resembles very closely the branching crystals of frost work.

The pattern may be varied in character by changing the thickness of the film of varnish. A single coat gives a small, delicate effect, while a thick film, formed by putting on two, three, or more coats, contracts so strongly as to produce a large and bold design. By using colored glass, a pattern in half tint may be made on the colored ground, and after decorating white glass, the back may be silvered or gilded.—*Amer. Architect.*

INTERIOR OF RIEDLINGEN CHURCH.

NEW EVANGELICAL CHURCH, RIEDLINGEN.

This church was built in the year 1879 for the evangelical "Diaspora-Gemlinde" of the city of Riedlingen at an expense of about $7,700. Th. Frey, architect, of Stuttgart.

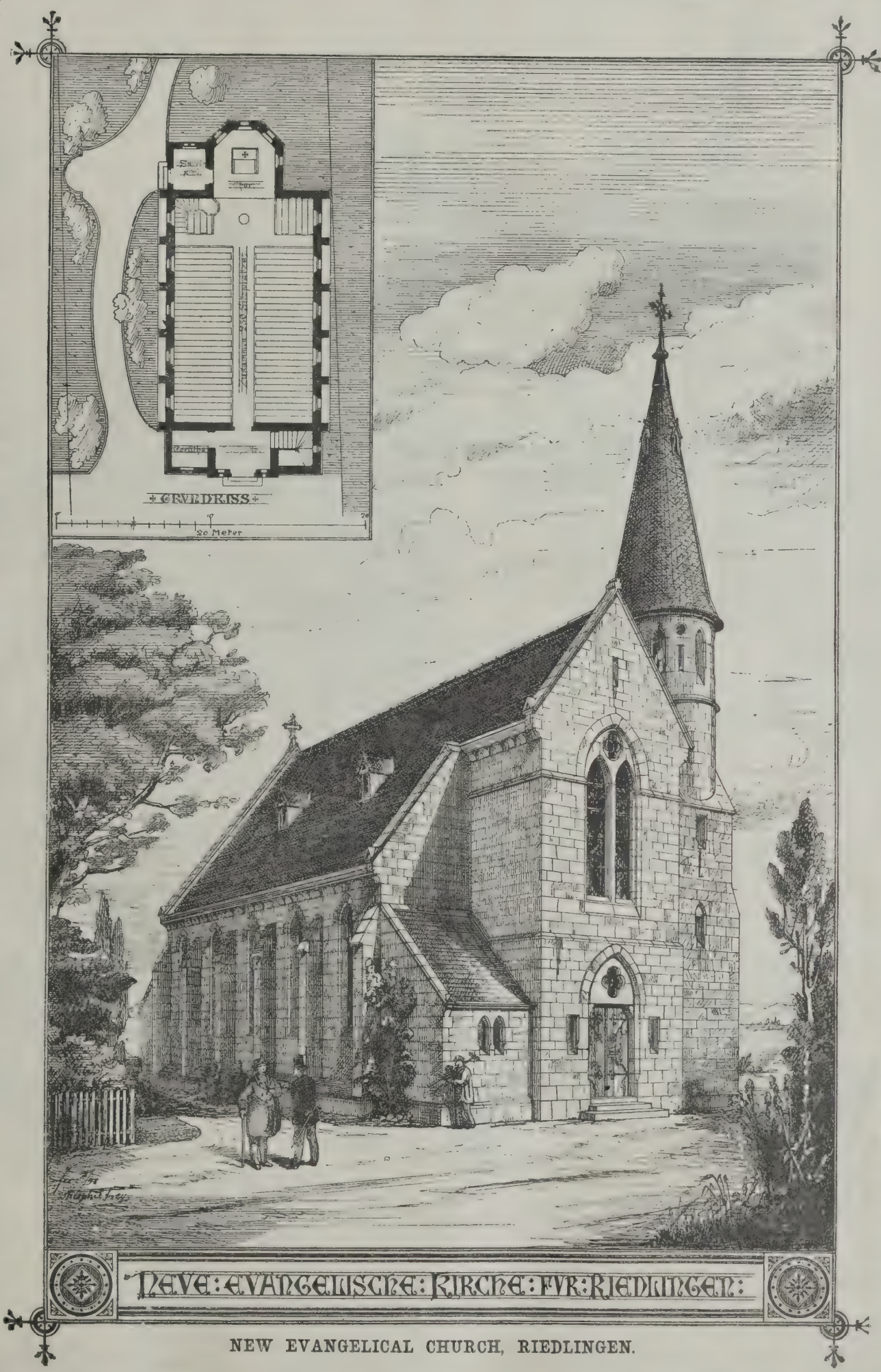
The plan shows a hall of rectangular form, with seating capacity for 250 people. Opposite the choir is the main entrance, with a vestibule, from which a winding stone staircase leads to the organ loft. The well of the staircase is continued into a clock tower, thus making the street corner on which the church is situated more prominent.

Diminution and Entasis of Columns.

Nothing is more beautiful than the stem of a growing tree which has a gradual taper as it ascends from the root, because no other form, in an elastic body, could be so well suited for carrying the weight of the top it has to support and for resisting those strains to which an object unsupported above must be subjected when agitated by the wind. Nature furnished the Greeks with this model; and to save the trouble of unnecessary workmanship, they were not at the pains to reduce the bottom of their posts to the same thickness with the top, when they formed them into a colonnade, although there was not now the same reason for the taper form that formerly existed. Thus far, while the materials consisted of wood, there might be little to blame; because the columns were certainly not weakened by that means, and they undoubtedly could be afforded at less expense. But when the columns came, in process of time, to be made of stone, no such argument could be adduced for adhering to the taper form. In this case a column is to be considered in no other point of view than as a perpendicular prop, consisting of incompressible and unelastic materials, which, of course, is as strong as it can be, in as far as respects its form, when it is of an equal thickness in every part; so that the thickness at the bottom is a mere useless waste of materials. Yet, from being in the habit of viewing wooden columns of that form, their eyes had become so far accustomed to it as no doubt to make them deem it elegant, so that they formed their columns of stone after the same model.

The power of habit operates equally upon the minds of those in our day who have been accustomed to contemplate with admiration the works of Grecian architecture, as in all respects perfect; and they would, I doubt not, consider it as a great inelegance were a colonnade in any case to be erected in which the columns were equally thick throughout their whole length. But that this decision originates merely in the prejudice that I have just indicated, I think it will not be difficult to prove. Let me ask any person who thinks himself qualified to judge in this case, what opinion he would have formed of the taste of Inigo Jones if, when he erected the piazzas in Covent Garden, he had made the pillars to taper inward at the top, instead of rising to their whole height in a perpendicular direction, as they now do? This case is so exactly in point, and the answer so obvious, that it is unnecessary for me to push the illustration farther. The Grecian artists, however, have run into one other deviation from the principles of common sense and, therefore, of good taste, in the form of their column, which can be traced to the same source of imitation as the former; and we, from the same cause, have been induced to follow them in it. The reader will easily perceive that I allude to the swell in the column, of which some artists have been so much enamored as to deem it an essential requisite of the most indispensable necessity.

For the origin of this defect we need not long be at a loss. Every person acquainted with the force of timber must know that, if a wooden prop were so much overloaded as to be obliged to bend, the yielding would take place toward the middle sooner than at any other place. Of course it would not be rendered in the least weaker by being made smaller at either end than in the middle. On this principle, while wooden pillars were still in use, the practice of making the column swell a little more toward the middle might have come into general use, as a way of obtaining equal strength with a smaller quantity of materials; but as the top of the post was naturally smaller than the base, that would be left in its natural state, while the bottom part only was somewhat diminished in size. This form of the wooden column being thus introduced, it might come to be deemed judicious, and thus be rendered fashionable, and of course be deemed elegant. In this state we may suppose things stood when the Grecian artists conceived the idea of making columns of stone; and, from mere habit, as we may naturally suppose, they adopted that form in preference to any other.—*J. Anderson.*



NEW EVANGELICAL CHURCH, RIEDLINGEN.

How Mirrors are Made.

One of the factories in Chicago employs 150 men and boys, and its spacious four floors present an interesting series of sights to visitors whose nerves are steel and tympani proof against splitting. On the first floor he will see huge stacks and piles of glass in assorted sizes, ranging from sixteen feet by seven feet square down to the smallest ovals for mirrors. These are all polished, some being run over by huge felt-covered wheels kept powdered with rouge, and the larger sheets scrubbed by sweating toilers with hand blocks covered with felt like a printer's proof planer in rouge. After the glass is thoroughly polished it is taken up to the next floor, where it is laid on tables and cut into the sizes ordered. It then passes into the hands of the bevelers, who, with sand and water and large grindstones, artistically finish the edges of the glass. It takes a trip upward again, to another floor, and is once more put through a polishing process, to remove any scratches or blemishes that may be on the glass. After every spot or scratch, no matter how minute, has been removed, careful hands convey the now beautiful and sparkling glass to the room where it goes through the final process, the silvering. Huge tables of cast iron or stone made like billiard tables, with raised edges, are used in the silvering room. These tables are of great strength and solidity, and all around the edge is a drain, for the superfluous mercury is poured over the tables in quantities sufficient to float the glass, which, after being tinfoiled, is gently and carefully pushed across the table containing the mercury. Great care must be used to prevent blemishes, the least speck of dust being ruinous to the mirror. Mercury, like molten lead, is always covered with a dirty scum which cannot be removed by skimming. The least bit of this scum would spoil the mirror. So the difficulty is obviated by shoving the scum along the edge of the glass. After successfully floating the glass on the mercury, a woolen cloth is spread over the whole surface and square iron weights are applied until the whole presents a compact mass of iron, two or three pounds to the square inch. After this pressure has been confined ten or twelve hours, the weights are removed and the glass placed upon another table of wood with slightly inclined top. The inclination is gradually increased until the unamalgamated quicksilver has drained away and only the perfectly amalgamated remains, coating the glass and perfectly adherent. This ends the process.—*Western Manufacturer.*

THE NEW MASONIC TEMPLE AT NEWPORT, KY.

We present an engraving of the new Masonic Temple at Newport, Ky., lately erected from the designs of Samuel D. Peacock, architect, Cincinnati, O., who gives us the following particulars:

The building is built of common brick and white mortar. The front is tinted where there is freestone and black brick. The caps and sills on the sides are all freestone, and also all chimney caps. The cornices and front gable ornaments are made of galvanized iron.

THE NEW MASONIC TEMPLE AT NEWPORT, KY.

The roof is best Virginia black slate. The fourth floor, over the main hall, is carried by two iron box girders, weighing 8½ tons each, and manufactured by the Keystone Bridge Co., of Pittsburg, Pa.

The second floor will be occupied as offices. The third and fourth floors will be occupied by the Masonic fraternity of Newport, Ky. The building is finished in Southern yellow pine and black walnut, oiled, varnished, and rubbed down with pumice stone and oil.

The floors are all double and deadened. The top floor is tongued and grooved yellow pine, and no board is over three inches wide. The joists are all poplar. There is a cornice around the ceilings of the third and fourth floors. The building, when completed, will have American plate glass in front and on the side of the first story.

The cost complete, with freestone sidewalk and all, was $23,000.

Clay Roofing Tile.

In a recent number of the *Brick, Tile, and Metal Review*, we find the following account of the manufacture of roofing tile as carried on at Akron, Ohio. Ordinary brick clay is used. "The grinding and tempering is done in tracers, such as used for sewer pipe. When tempered, whatever is put into the cylinder is forced out at the end of the stroke in a series of parallel plates, about 6 in. wide by ⅜ in. thick, and extending along until cut up in lengths. Considerable oil is used to keep the clay smooth and to keep the freshly pressed plates from sticking. These plates are adjusted, one after another, on a series of disks arranged on the circumference of a circular revolving disk. This disk moves through one-sixth of its circumference at a stroke, boring in succession each plate of clay spread out on its table under a compound piston. This piston is arranged to cut off the edge of the plate in a symmetrical shape, and then to press it into the required shape. The pressed tiles are removed and set in piles to dry. Drying takes about two weeks in a steam heated chamber, as the oil used in the pressing of the clay hinders the escape of the water.

"They are finally piled in loose order in a kiln to a depth of about 6 ft., and subjected to a light burn. The kilns employed are circular down draughts. The ware is of several classes. Shingle tile, which are more like shingles than anything else, are slabs of burnt clay 12×6 in. × ⅜ in., with holes in proper places for nailing them to the roof. Their uses are as nearly like those of a real shingle as well can be. About 5 in. of each tile are exposed to the weather. The so-called 'diamond tile' are made to hook into each other, but are also supplemented by nails. They are more ornamental than the shingle tiles, but as they are more dependent on each other for support, they are not so durable or strong. One of the chief objections to a tile roof is its weight; a 10 ft. square of plain shingle tile weighs about 1,100 pounds, and the same area of diamond tile weighs from 650 to 850 pounds. The advantages claimed for them are durability, beauty, and immunity from danger by fire or lightning."

A DWELLING FOR $5,600.

Our engraving shows a dwelling for $5,600, the general dimensions of which are: Front, 33 feet 10 inches; including bay window, 38 feet 8 inches; side, 48 feet 6 inches, not including piazza.

For size of rooms see floor plans.

Height of Stories.—Cellar, 7 feet; first story, 9 feet 6 inches; second story, 9 feet; attic, 8 feet.

Materials —Foundation, stone; first and second stories, clapboards; gables, shingles; roof, slate.

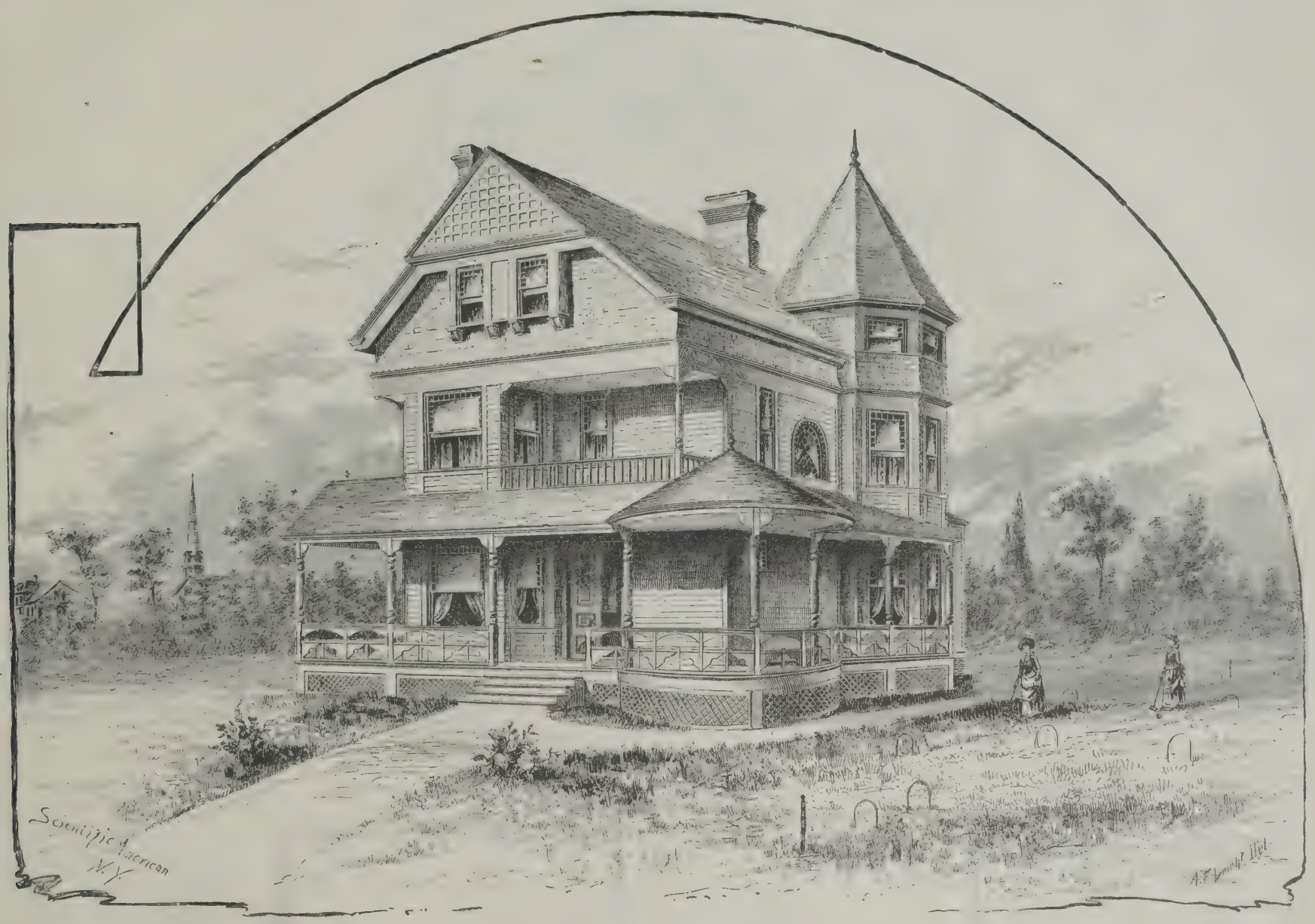
Cost.—Complete, including mantels and hot air heater, $5,600.

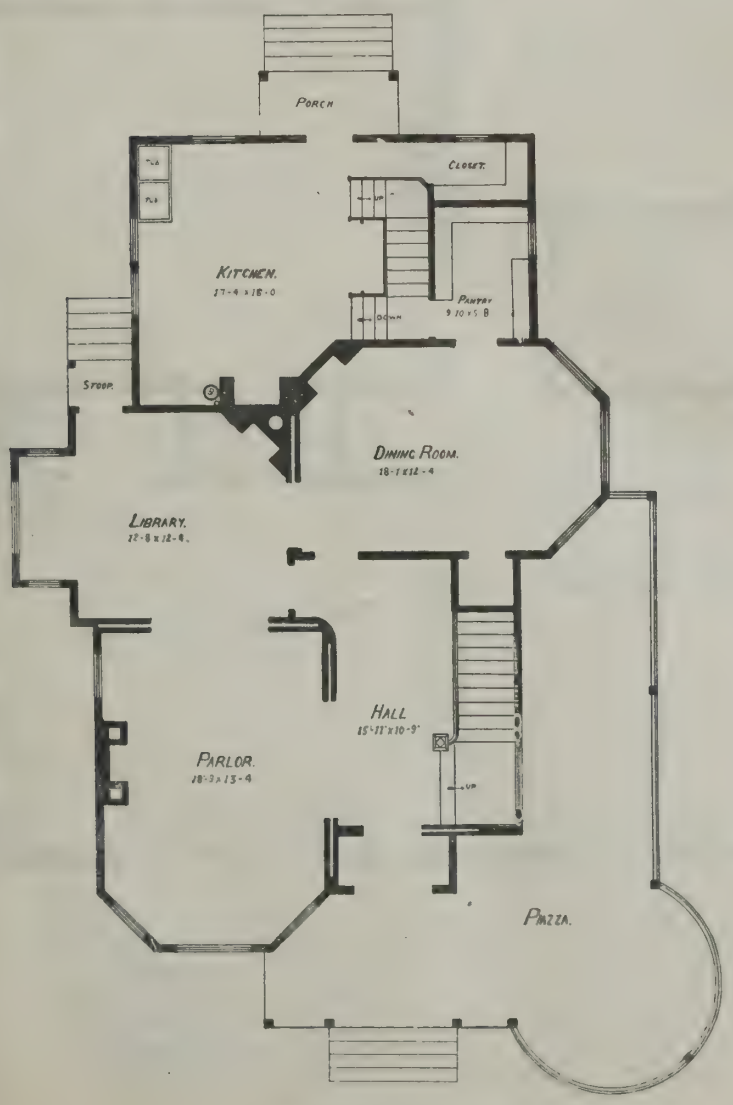
Special Features.—Open fireplaces are provided in the parlor, dining room and library, also in one chamber on the second floor. The attic is entirely finished. There is a cellar under the whole house.

A Sewer Stopped by Tree Roots.

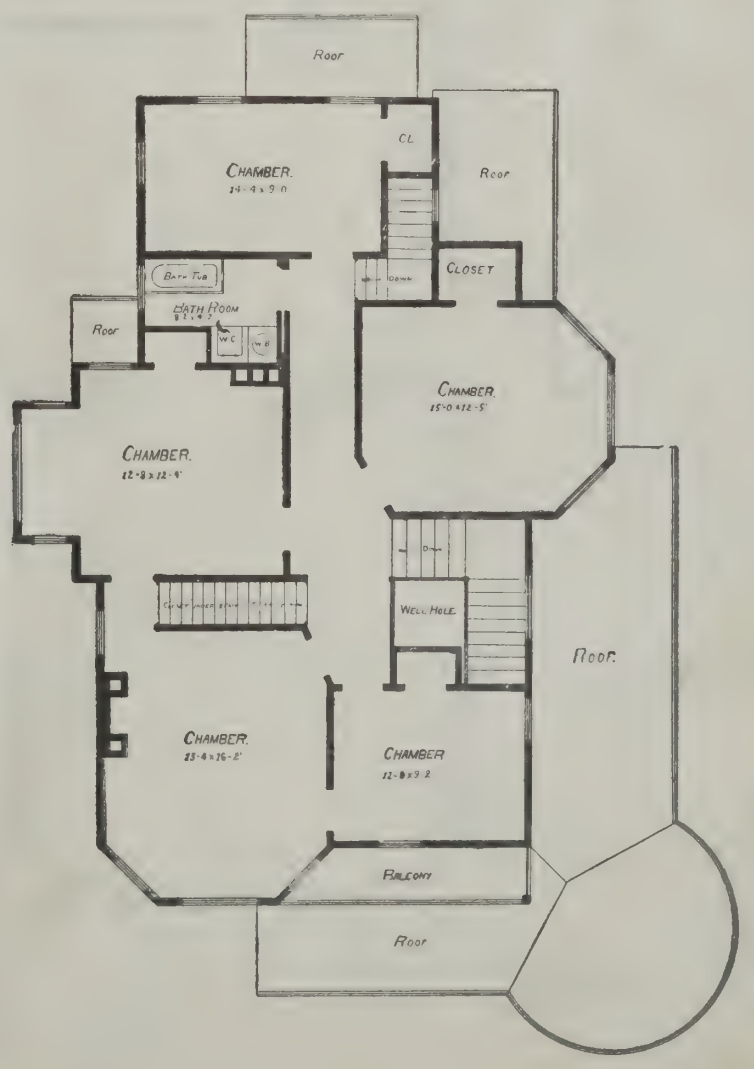
A Milwaukee correspondent of the *Eng. and Buil. Record* reports a case of the roots of a tree stopping up a sewer, which was recently found by a Milwaukee plumber. Being unable to clear the sewer from the cellar, it was dug up outside and found choked up solid with tree roots. The roots were matted together and made a very solid mass. The sewer is made of cement pipe and was laid wrong end to, *i. e.*, with the hub ends toward the street. The sewer was only six feet deep and the joints were not made perfectly, some being only half cemented. The roots extended out into the street and for a distance of 40 feet into the house, *i. e.*, 40 feet from curb. They were both inside and outside the sewer and followed it in the trench for 20 feet inside the cellar.

A MASTODON'S tusk, four feet long, has recently been placed in the public museum in Milwaukee. It was found at Dover, Wis.





FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

A DWELLING FOR $5,600.

A DWELLING FOR $2,900.

The dwelling herewith illustrated measures as follows: Front, 30 feet over all; side, 36 feet 6 inches, exclusive of piazza. The floor plans show the sizes of the rooms.

In height, the stories are: Cellar, 7 feet; first story, 9 feet; second story, 8 feet 6 inches; attic, 8 feet.

Materials.—Foundation, stone; first and second stories, clapboards; gables, cut shingles; roof, slate.

Cost.—$2,900, not including furnace and mantels.

Special Features.—This house may be heated by a furnace. There is a fireplace in the dining room. The attic has two bed rooms. There is a cellar under the whole house.

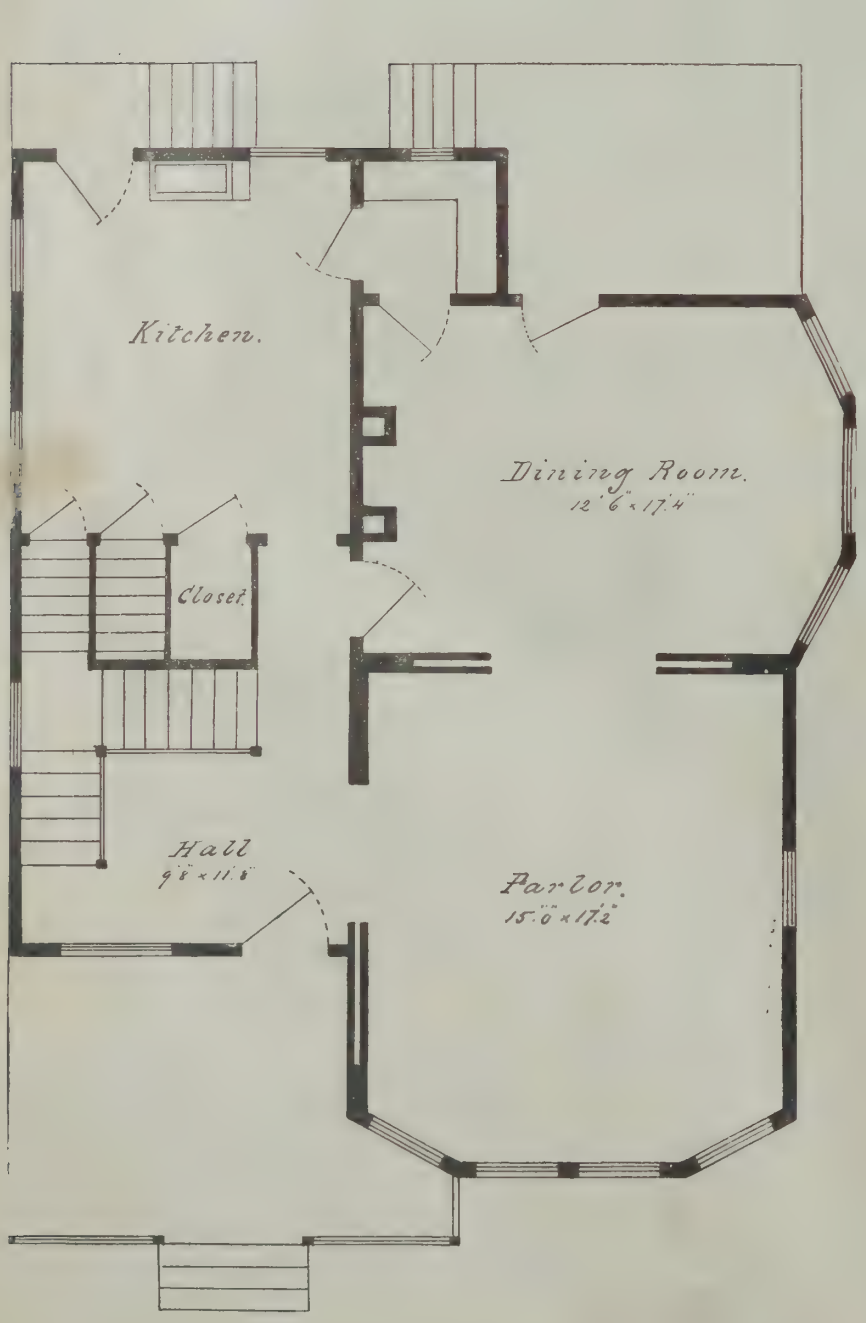
A RESIDENCE AT CHATTANOOGA, TENN.

We herewith give drawings of first and second floor plan and perspective of a residence in Chattanooga for Mr. D. J. Chandler, of which the architect is Mr. W. H. Floyd, of same place.

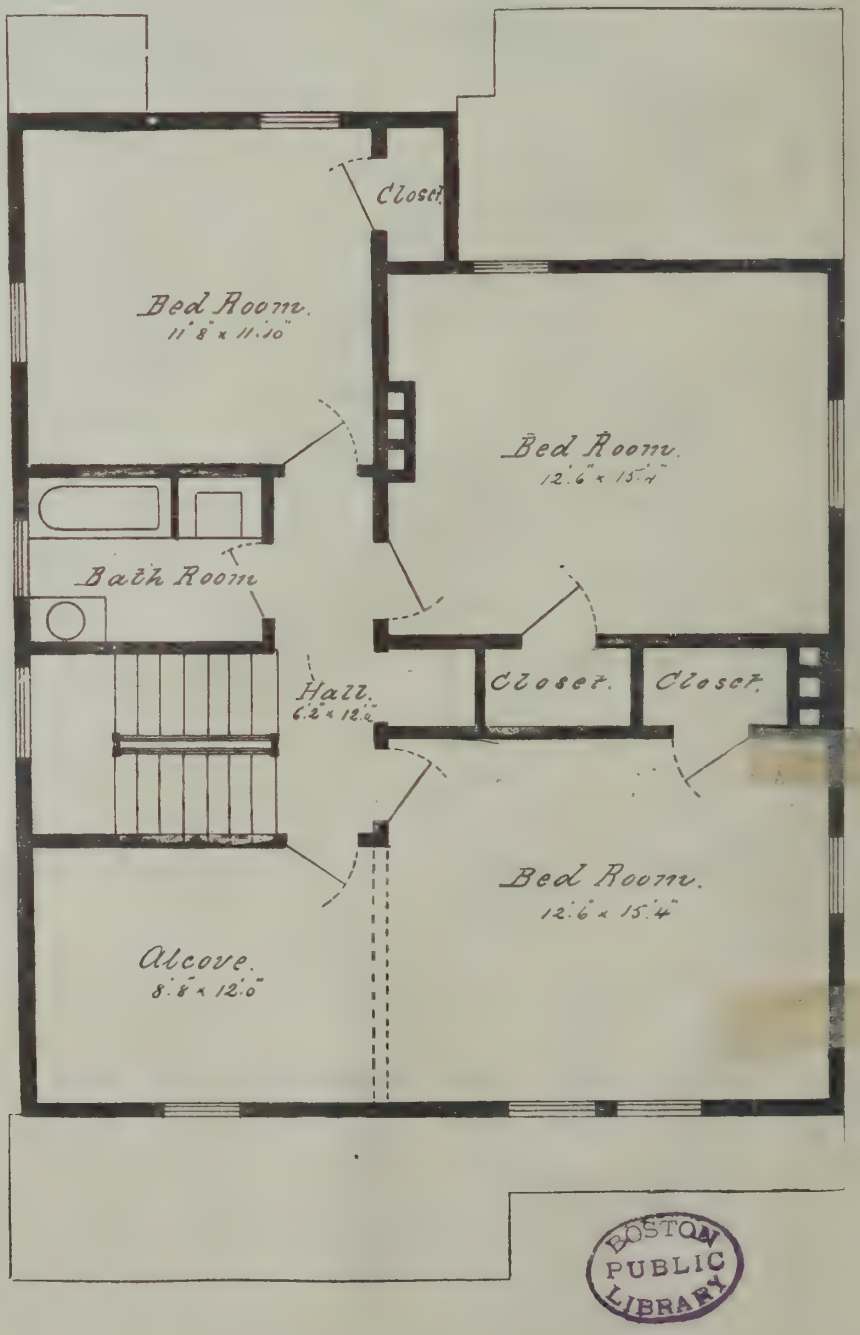
The building is to be of Zanesville pressed brick, with Kentucky blue sandstone and terra cotta trimmings, and will cost $20,000.

The interior finish will all be hardwood: the hall will be finished in quarter-sawed white oak; the dining room in the same materials; the parlor, library, and family room, in mahogany; also the second floor chambers, mantels, arches, screens, etc.

The design displays originality and merits which we think will be interesting to architects and builders.



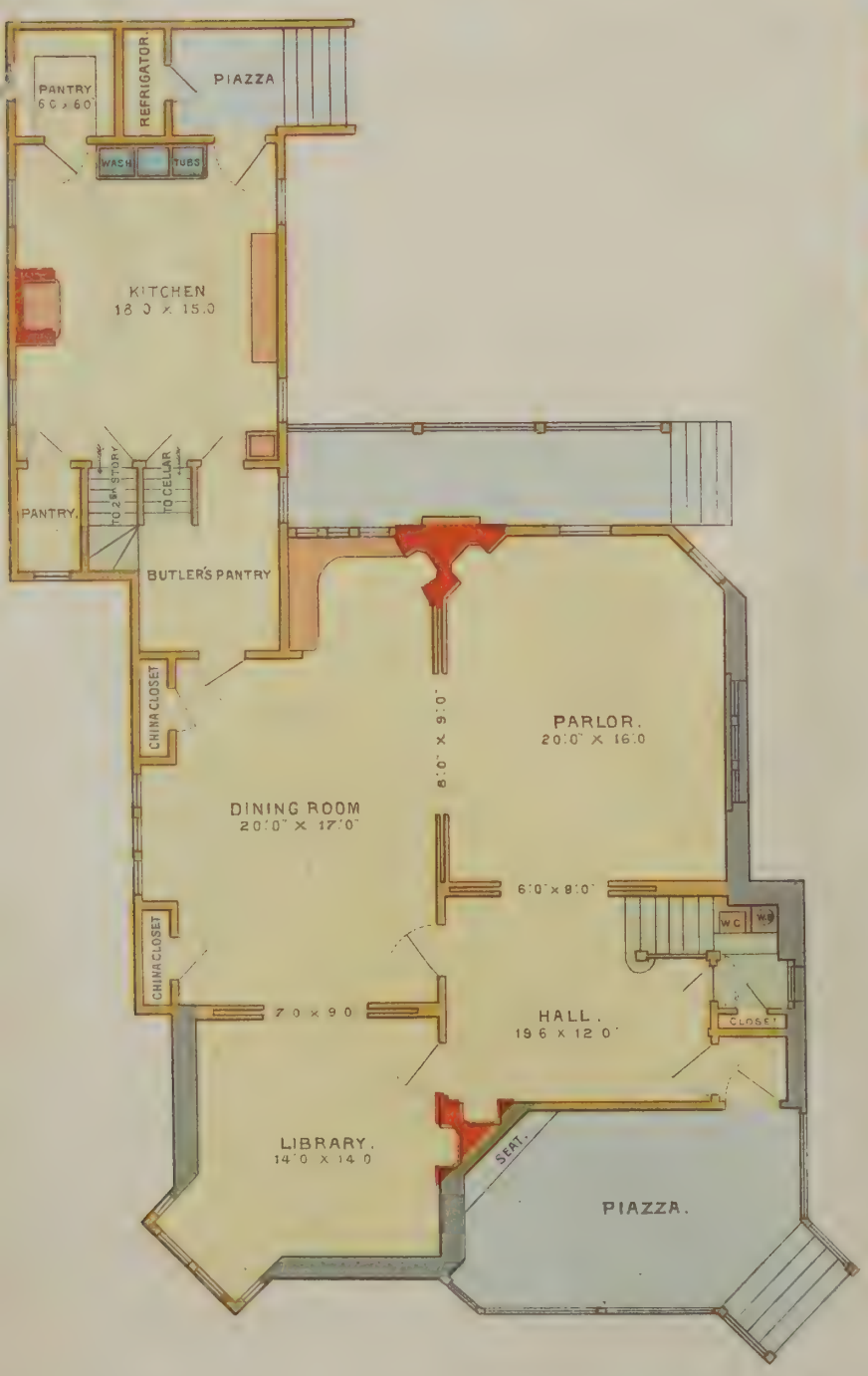
FIRST STORY PLAN



SECOND STORY PLAN

A DWELLING FOR $2,900.

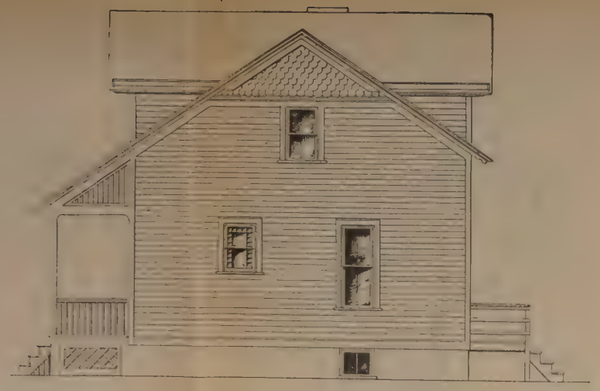
A Residence in Michigan.



Plan of First Floor.

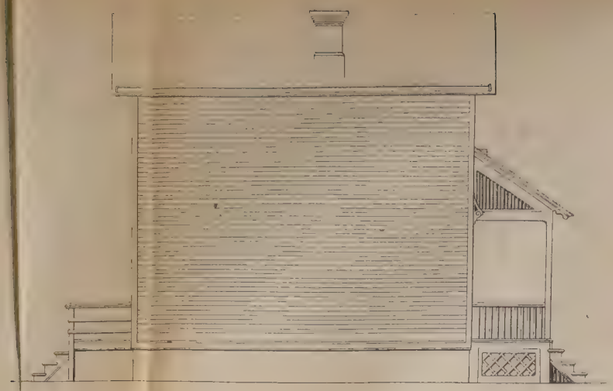
Plan of Second Floor.

FRONT ELEVATION.



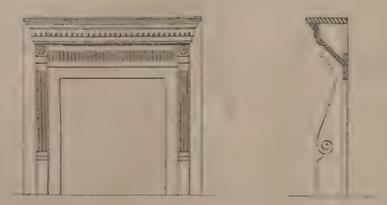
SIDE ELEVATION

REAR ELEVATION

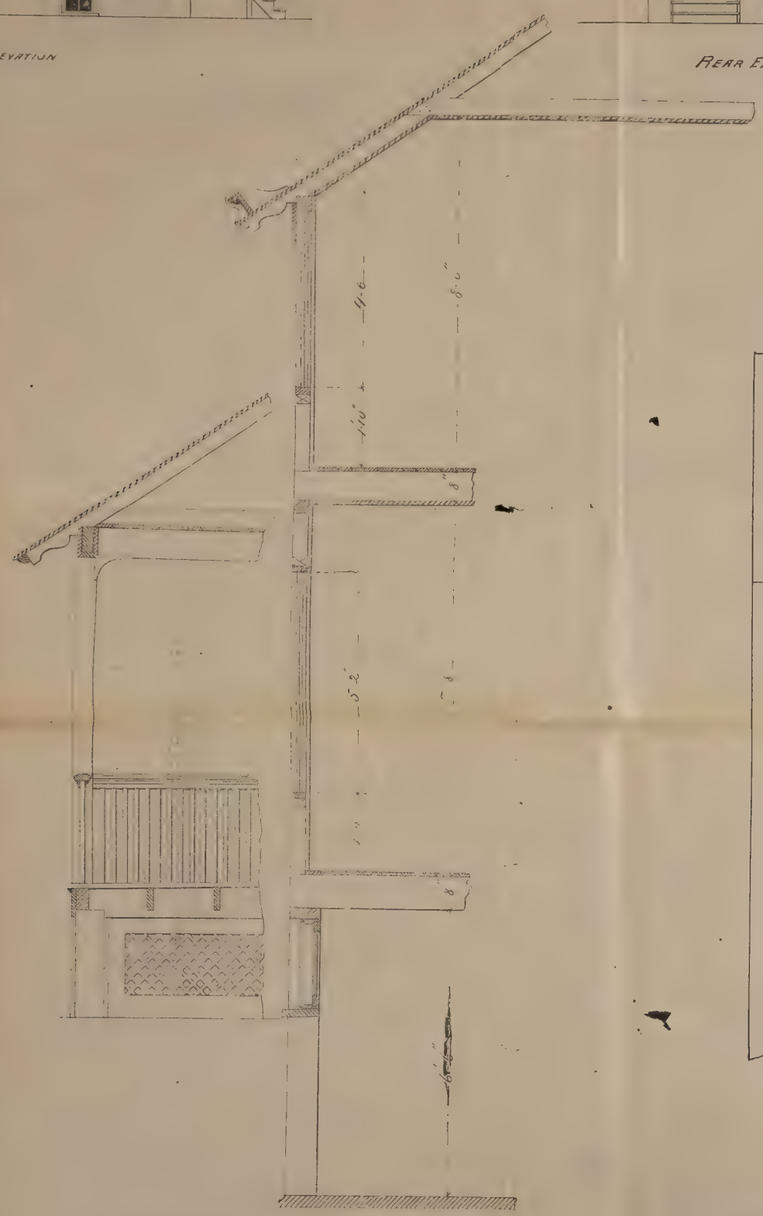


SIDE ELEVATION.

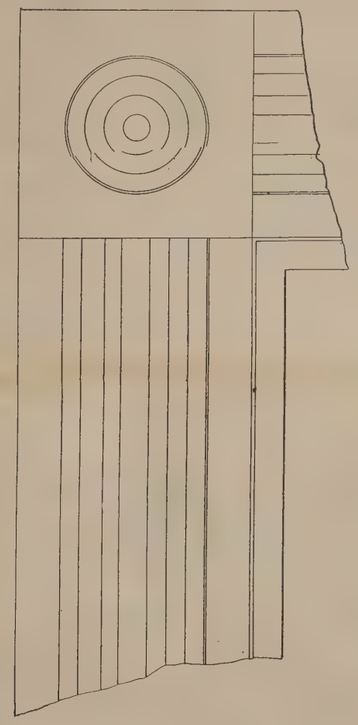
Elevation of Staircase.

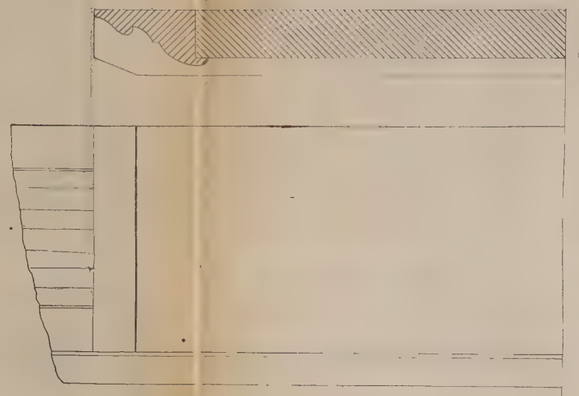


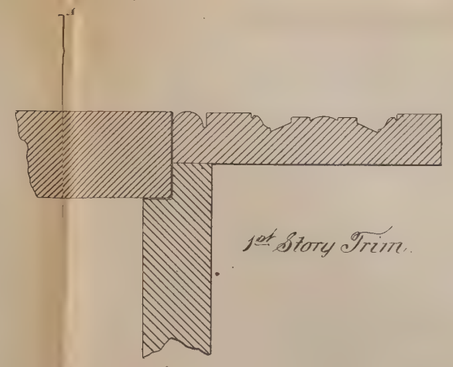
Elevation & Section of Mantel.



Perpendicular Section, showing heights of Stories, Porch &c. &c.







1st Story Trim.

A Cottage for One Thousand Dollars.

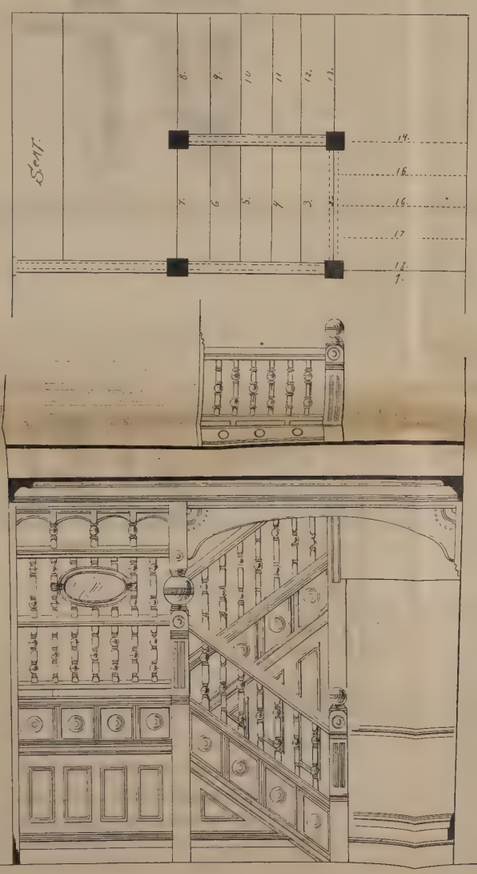
Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for January, 1888.

PLAN of STAIRCASE.

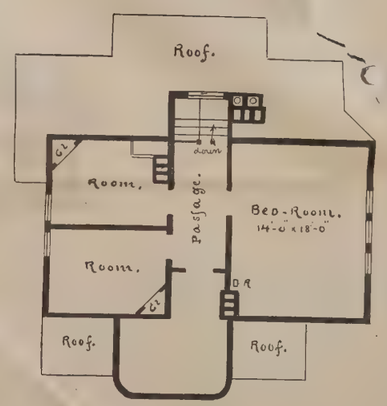
HALF INCH SCALE DETAILS

STAIRCASE.

CELLAR PLAN.



STAIRCASE

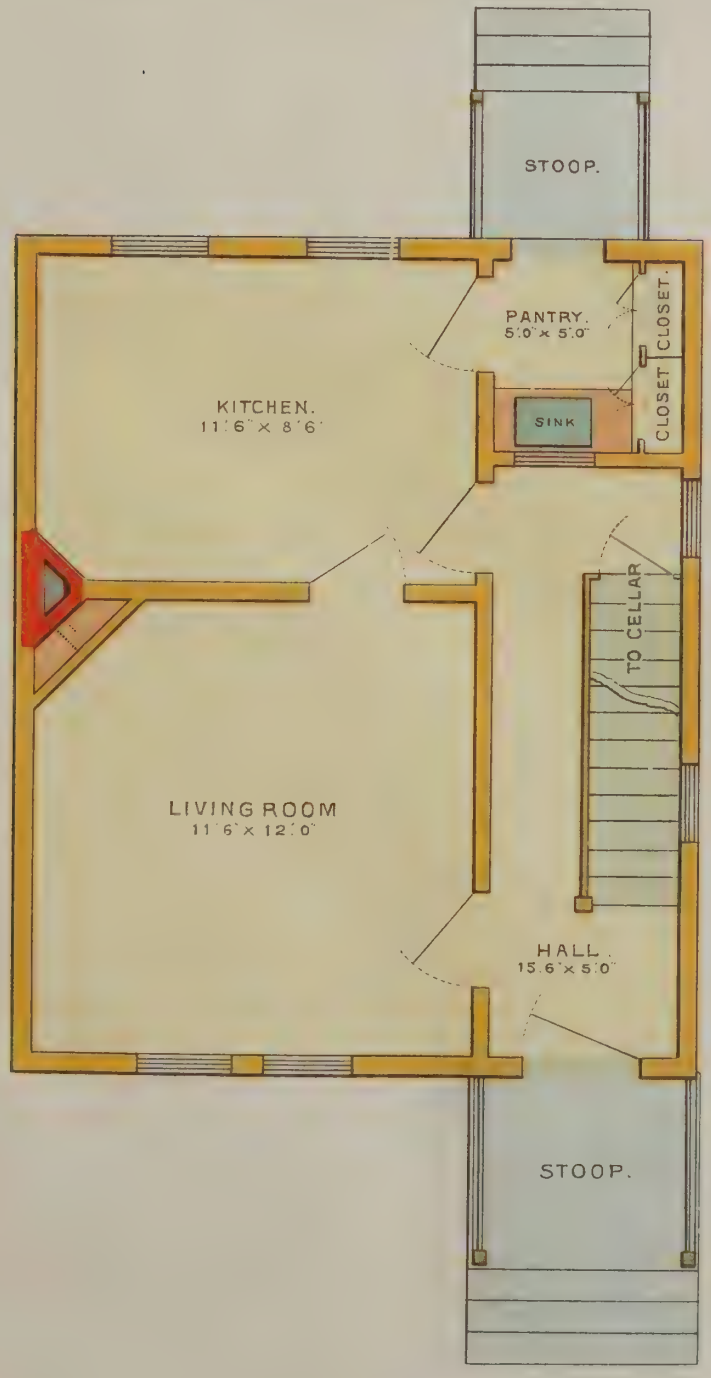


ATTIC PLAN.

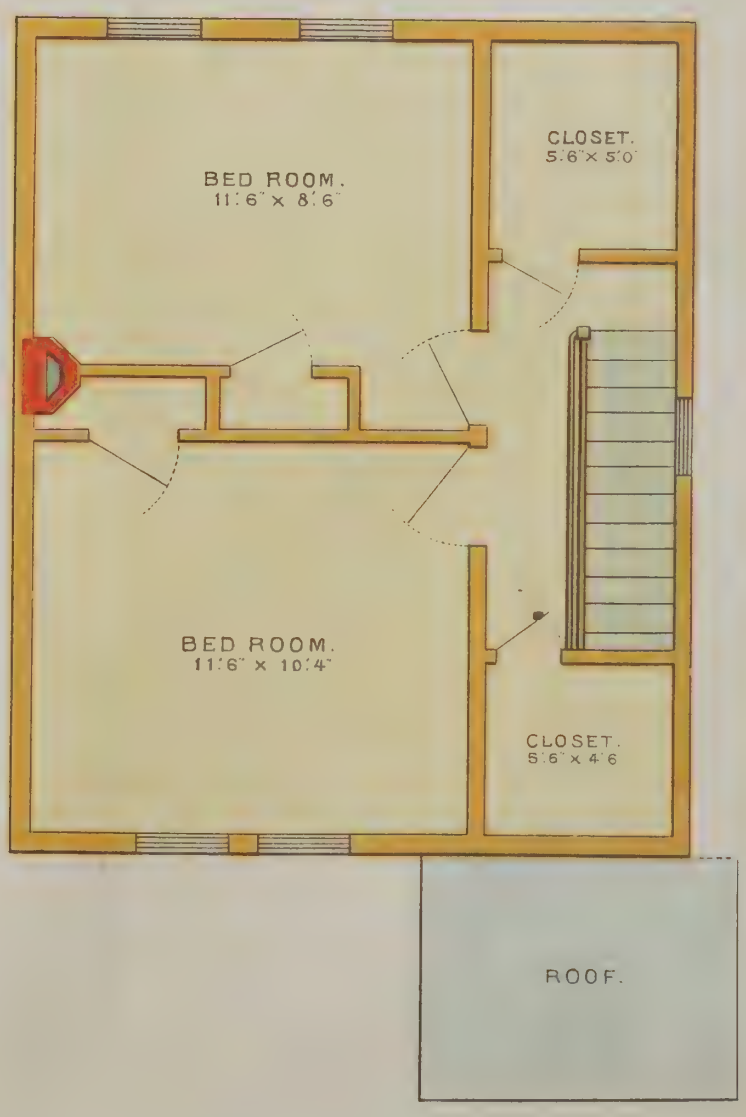
Two Dwellings at Orange, New Jersey.

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for February, 1888.

A Cottage for One Thousand Dollars



Plan of First Floor.



Plan of Second Floor.

SCHUMACHER & ETTLINGER, NE

A HOUSE COSTING $7,000.

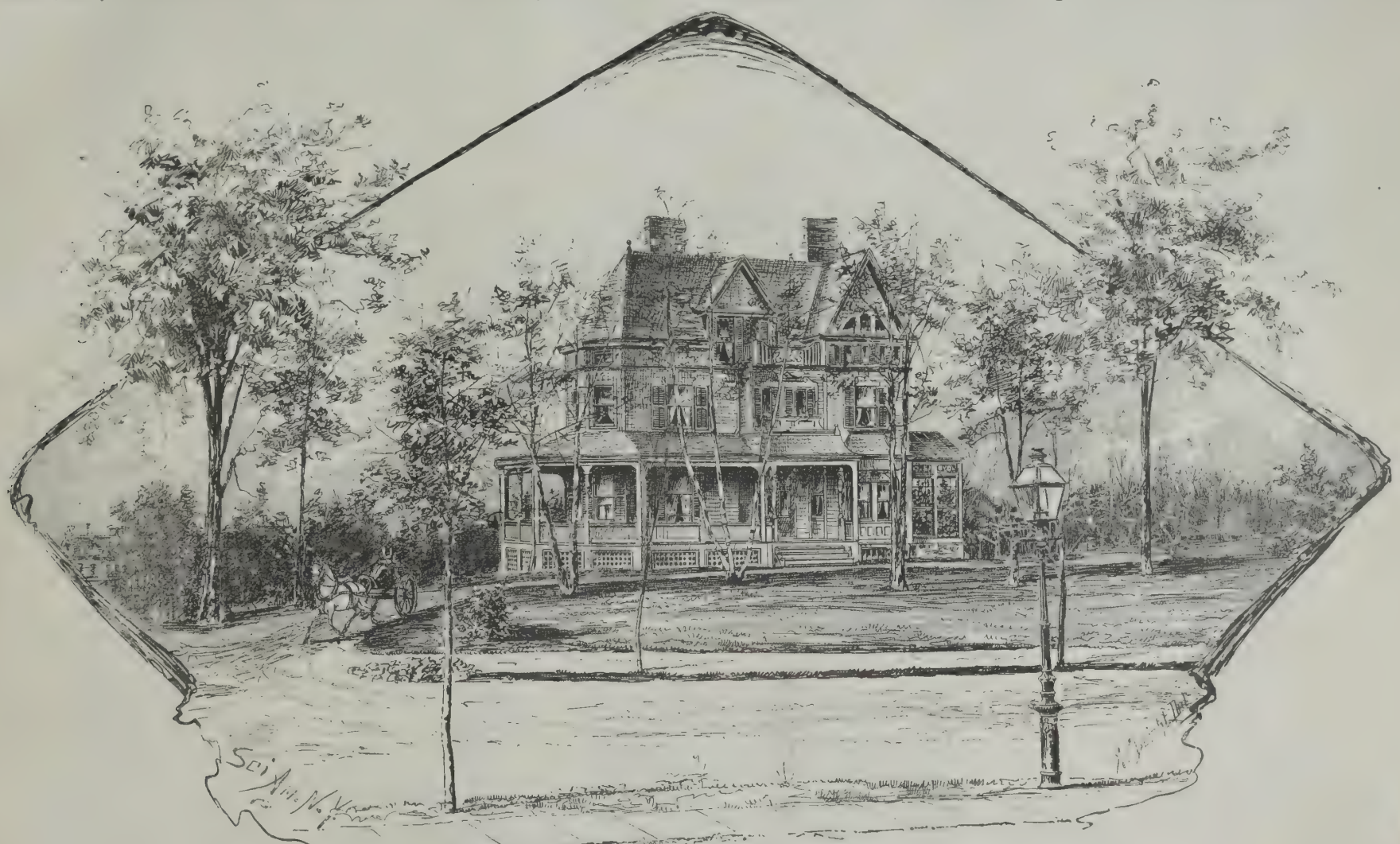
The general dimensions of the dwelling here illustrated are: Front, 42 feet, exclusive of bay window; side, 47 feet, exclusive of piazza.

Size of Rooms.—See floor plans.

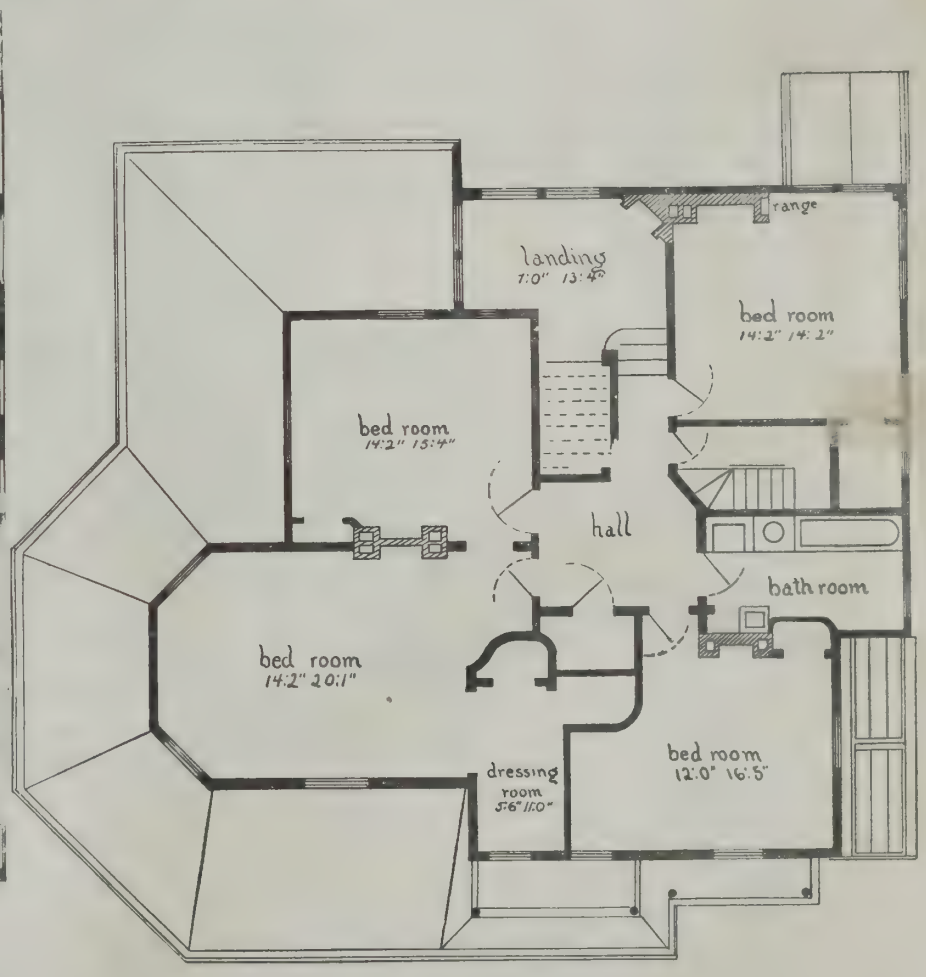
Height of Stories.—Cellar, 7 feet; first story, 10 feet; second story, 9 feet 6 inches; attic, 8 feet.

Materials.—Foundation, stone; first and second stories, clapboarded; roof, shingles.

Cost.—$7,000, without furnace and mantels.



FIRST FLOOR.



SECOND FLOOR.

A HOUSE COSTING $7,000.

Special Features.—This house is designed to be heated by a furnace. Fireplaces are provided in dining room, library, parlor, and four chambers. Attic finished. Cellar under the whole house.

A Handy Furniture Polish.

Make a mixture of olive oil one part and vinegar two parts. Apply it to the furniture with a Canton flannel cloth. Rub dry with another cloth of same material. A housekeeper who uses this polish on the finest varnished furniture says it has no equal.

Architects, Clients, and Builders.

It is a principle of law and equity that an agent is not allowed to make any profit out of the agency, without the knowledge and consent of his principal, beyond his proper remuneration; and any sums of money so obtained by an agent from any other source must be accounted for to the principal, who may claim it as money received to his use. Where, therefore, an engineer (and this case again equally refers to an architect) entered into a sub-contract with the contractor without the knowledge or consent of the employer, it was held that any surreptitious dealing between the contractor and the engineer was a fraud, and entitled the defrauded employer, if he came in time, to have the contract which was entered into without his knowledge or consent rescinded, and to refuse to proceed with it in any shape. So, on the other hand, the architect should not, without the knowledge of the builder, enter into a contract or engagement with the employer. If, besides the contract between the employer and the builder, there is a contract between the employer and the architect, not communicated to the builder, that the outlay shall not exceed a given sum, and the builder is, by the contract, subject to the orders of the architect as to what works he shall execute, this agreement is not binding upon the builder, and such restriction of the architect's authority by contract, as agent for the employer, cannot in any respect prejudice the builder's rights.

And in order to enable the employer to claim the benefit of a proviso that the architect was to arbitrate in all matters between him and the builder, it is essential that the fact of such a contract as above mentioned, between himself and the architect, should have been communicated to the builder, and distinct notice of such an engagement given to him previously to his entering into any contract, as otherwise the architect would be put in a position of undue bias.

If, however, the builder was aware of the agreement between the architect and his employer, and of the fact of the architect's interest in consequence, the builder would be bound.—*The Architect.*

The Mortimer Apartment House.

The Mortimer apartment house, in Minneapolis, was burned on the morning of the 7th of November, the fire lasting only about thirty minutes. It was in course of construction, the work being just ready for the plasterers. When completed, it would have been one of the largest and finest apartment houses in the West. It is described as of modern design architecturally, and would have cost complete and furnished $240,000. There were three hundred and thirteen rooms, sixty-three halls, and two hundred and fifty closets. It was seven stories high, with a basement, constructed of Kasota stone, red pressed brick with Bayfield sandstone trimmings. It was to have been fire-proofed with patent stiffened-wire lath. The main entrance on 13th Street was of Bayfield sandstone, the steps and platform being of pink Kasota stone, each step fourteen feet long, made in one piece. The interior was to have been fitted up with all modern appliances. Two Hale hydraulic passenger elevators and one freight elevator were to have been put in, and steam heat, with incandescent lights, were to have been used. Electric bells, a telephone and messenger boy service on each floor, and mail chutes from each hall to the main floor, were also among the appliances designed to have been used in the building.

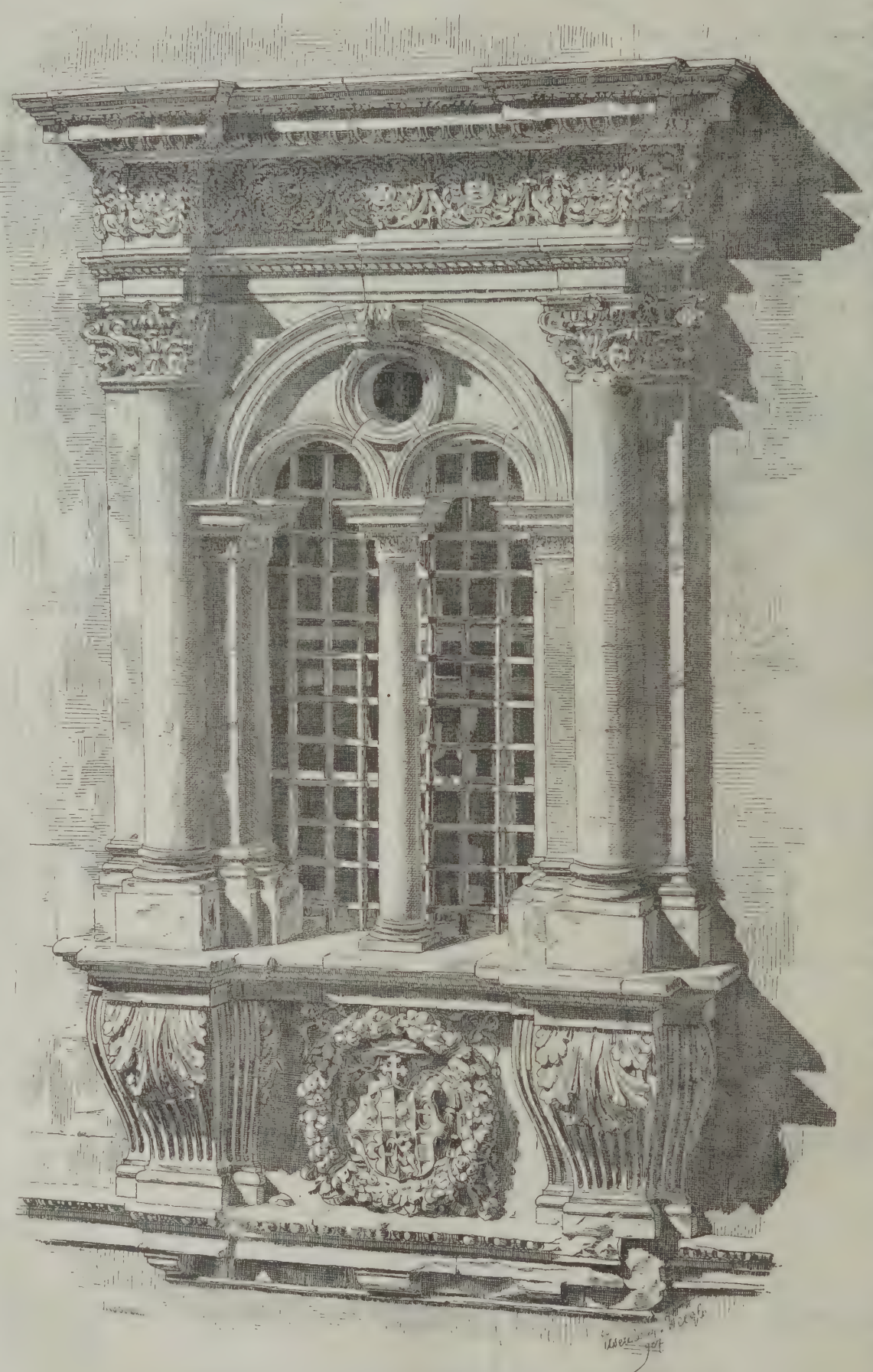
There is much severe comment among architects and contractors in regard to the house. It is claimed that from the architectural nature and design of the building it must have been a death trap at the best. Its internal structure was of wood almost exclusively, and it was so high as to be beyond the reach of the department in case of fire. The walls were of the weakest character, as was proved by their early giving way. As a whole, the structure is severely condemned by competent authority. However, in justice to Mr. Hoover, the architect, it must be said that so long as he complied with the wishes of his principal and the city ordinances, he should not be censured. Nor is it clear that Mr. Mortimer should be blamed for the erection of a building not open to criticism as in violation of the building laws. The discussion of the building and the testimony of the city officers show that the law was complied with in every particular, and that official inspection had been frequent and thorough.

But the question of allowing the construction of such buildings arises. It is an apparent fact that in fighting fire in such structures the department of any city the size of Minneapolis or St. Paul is inefficient. It becomes a very serious question whether the erection of any building for apartment purposes more than six stories in height should not be prohibited, except it be strictly fire-proof. Had the Mortimer house been completed and filled with tenants, the loss of life in case of the destruction of the building by fire must inevitably have been horrifying. It is the duty of the authorities to prevent such disasters by prohibiting their causes. The destruction of this modern shell should direct the attention of the public to the subject so forcibly as to cause action to be taken looking to the proper regulation of the construction of apartment houses.—*N. W. Architect.*

Powdered glass is largely taking the place of sand in the manufacture of sandpaper. It is readily pulverized by heating it red hot and throwing it into water, the finishing being done in an iron mortar. By the use of sieves of different sized meshes, the powder is separated into various grades.

Sewer Poison.

How shall one know when he is poisoned by sewer gas? is a question frequently asked. Dr. Hun, in the *Medical News*, says that he has carefully studied twenty-nine cases, and thinks it probable that the following condition may result from sewer gas poisoning: Vomiting and purging, either separately or combined; a form of kidney trouble; debility, in some cases in which the heart is especially involved; fever, which is frequently accompanied by chills; sore throat, which is frequently of a diphtheritic character; neuralgia. These conditions may occur separately, but are frequently combined, and it is especially common for the fever to be associated with the other forms of sewer gas poisoning. Finally, in cases of sewer gas poisoning, there is one group of symptoms which is almost always prominent, and these symptoms are loss of appetite, drowsiness, extreme prostration, and a dull, unpleasant feeling in the head; and whenever this group of symptoms occurs, not as the result of an attack of acute disease, but as a chronic condition, a suspicion is justified that the patient is exposed to sewer gas infection. More or less satisfactory evidence has been adduced that the following diseases may result from sewer gas poisoning: Zymotic diseases, such as typhoid fever; pneumonia, diphtheria, cholera, dysentery, cerebro-spinal meningitis, erysipelas, and scarlet fever; a condition of asphyxia which, in its severe form, is characterized by coma, convulsions, and collapse; puerperal fever, abscesses, lymphadenitis, and possibly acute aural catarrh.—*American Analyst.*



A WINDOW IN THE CATHEDRAL OF MURCIA, SPAIN.

BRISTOL CATHEDRAL.

An Augustinian monastery, founded by Robert Fitzhardinge in 1142, had its church, of Norman architecture, to which additions were made in the early English period. When Edmund Knowle was abbot, from 1306 to 1332, the Norman choir was replaced by that which now exists. His successor, Abbot Snow, built the chapels on the south side of the choir. Abbot Newland, between 1481 and 1515, enriched the transepts with a groined roof and with ornamental work of the decorated Gothic style, and erected the central tower. Abbot Elliott, who followed Newland, removed the Norman nave and aisles, intending to rebuild them; but this was prevented by his death in 1526 and by the dissolution of the monastery a few years afterward; he completed, however, the vaulting of the south transept. The church remained with a nave, and otherwise incomplete, until the modern restorations; after which, in 1877, it was reopened with a special service. Messrs. Pope & Bindon, of Bristol, were the architects employed. The exterior, of which we give an illustration, viewed from St. Augustine's Green, or Upper College Green, is not very imposing; from the Lower Green there is a good view of the central tower and the transept. The height of the tower is but 127 ft. It is of perpendicular Gothic architecture, but the piers supporting it are Norman. The interior presents many features of interest. The clustered triple shafts of the piers in the choir, with their capitals of graceful foliage, the lofty pointed arches between them, and the groined vaulting, have much beauty. The chancel is decorated with tracery of a peculiar pattern.

The Abbey of St. Augustine at Bristol was surrendered to King Henry VIII. in 1538, and became, in 1542, the cathedral of the new Episcopal see then created. The first Bishop of Bristol, Paul Bush, was deprived of his see by Queen Mary, being a married clergyman and refusing to part with his wife. Bishop Fletcher, in Queen Elizabeth's time, afterward Bishop of Worcester and of London, was twice married, at which this queen likewise expressed her displeasure. He was father of Fletcher, the dramatic poet; and he is said to have been one of the first English smokers of tobacco. Among noted Bishops of Bristol were Bishop Lake, afterward of Chichester, and Bishop Trelawny (Sir Jonathan Trelawny, Bart., of Cornwall), two of the "seven bishops" imprisoned for disobeying an illegal order of James II. "And shall Trelawny die? Then twenty thousand Cornishmen will know the reason why." But the most eminent was Bishop Joseph Butler, the author of "The Analogy of Natural and Revealed Religion" and of the "Sermons on Human Nature." He was born at Wantage, in Berkshire, and was educated as a Nonconformist. He was Bishop of Bristol from 1738 to 1750, when he was translated to Durham. In 1836, the see of Bristol was joined with that of Gloucester; and the Right Rev. Drs. J. H. Monk, C. Baring, W. Thomson (now Archbishop of York), and C. J. Ellicott have been Bishops of Gloucester and Bristol.—*Illustrated London News.*

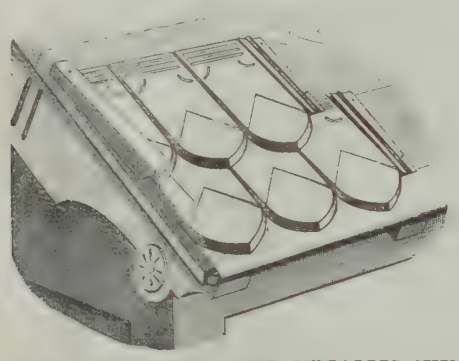
New Haven, Conn., was invaded by a flock of birds one evening recently from 9 to 11 o'clock. Thrushes, linnets, catbirds, and even humming birds thronged about the electric lights, and many of them entered stores and dwellings and were caught. The only explanation offered was that flocks of these birds flying southward were attracted by the bright electric lights, and foolishly stopped in their long journey.

BRISTOL CATHEDRAL.

METALLIC ROOFING.

The National Sheet Metal Roofing Company, of New York City, have had great success in introducing the Walter's patent metallic shingle and their roofing sundries, of which we give several illustrations in this connection. They are extensively used, and can be found on buildings in a great many of our towns and cities. Among some of the prominent buildings on which they are used may be mentioned: St. Cecelia's Church, 106th Street and Lexington Avenue, New York City; Bristol County Jail and House of Correction at New Bedford, Mass., with copper shingles; Institution for the Education of Deaf and Dumb, Jacksonville, Ill.; Woodstock College, Woodstock, Md.; Loyola College, Baltimore, Md.; Marine Barracks, Navy Yard, Pensacola, Fla.; Colorado State Insane Asylum, Pueblo, Colo.; Insane Asylum, Fort Steilacoom, Washington Ty. The Savannah, Florida & Western Railroad use them largely, and private buildings in every town of importance in the United States and Canada.

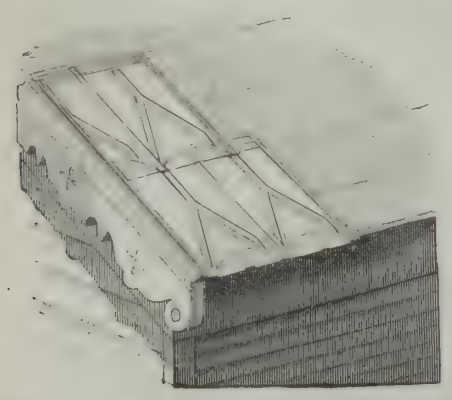
In the cut of the dwelling shown herewith the main roof, porches, and turret are covered with the company's standard 10 × 14 tin shingles; the gables and belt courses with their Queen Anne shingle; and the ridges, hips, gable edge, and valleys are lined with metal manufactured for such purposes by them.



COOPER'S PATENT QUEEN ANNE METALLIC SHINGLES.

Their Queen Anne shingles are joined by the use of the Walter's patent lock, which feature has revolutionized the art of metal roofing when applied to buildings having a pitch equal to the ordinary shingle roof.

The Walter's lock consists of two parallel corrugations with a gutter between them, and a nailing flange

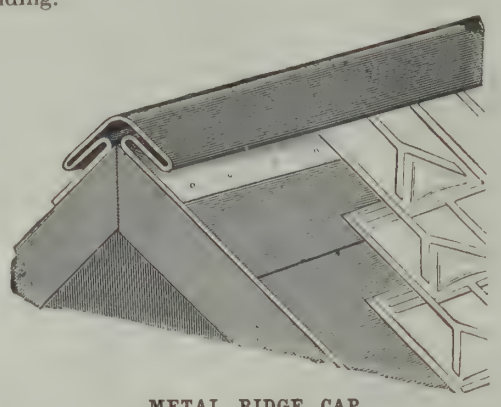


WALTER'S PATENT STANDARD METALLIC SHINGLES.

at the side of the gutter through which it is nailed to the roof of a house, and on the other side a broad corrugation which forms a seam with another shingle of like construction.

One of the most important features covered by their patents are the corrugations at the upper end of the plates, which consist of two or more corrugations or dams extending continuously across the top of each plate for the purpose of preventing water being blown upward underneath the lower edges of the overlapping shingle, and the bracing corrugation, which is highest at the center, tapering to each side, which stiffens the lower edge and causes it to lie close to the surface of the underlying plate.

In addition to durability and fireproof qualities, this shingle has considerable artistic effect, which enhances the value of a dwelling much more than the difference in cost between this and an inferior class of material. The roof of a well constructed house is second only in importance to its foundation, for upon it depends the preservation of the entire superstructure, and should be made the subject of like care at the time of building.



METAL RIDGE CAP.

All interested in building should send to the National Sheet Metal Roofing Co., 510 to 520 East Twentieth St., New York, for their recent catalogue, which is fully illustrated, showing all of their roofing sundries, and giving much valuable information, and which they will be pleased to mail free to any address.

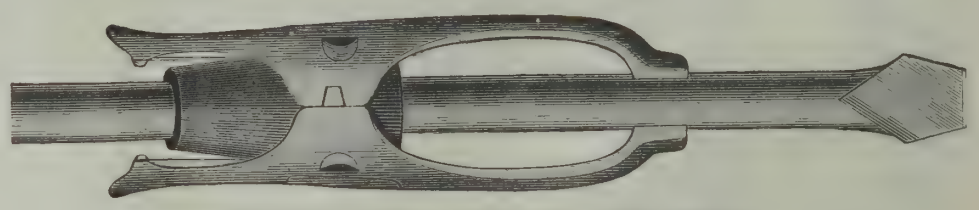
Boiling Bricks in Tar.

The coating of brick and wooden structures with coal tar, as a rough and ready means of preserving them from the action of damp, has been common from the earliest days of the gas industry. It has also been usual in chemical works to protect the stones used in the construction of acid tanks, etc., by a preliminary soaking in heated tar. But the great improvement in strength and impermeability to moisture which results from the simple operation of boiling bricks and stones in gas tar is certainly not so generally known as it should be. Professor Lunge, in the new edition of his work, "Coal Tar and Ammonia," draws attention to the subject, and indicates several useful applications. He points out that drain and roofing tiles, which are quite porous and brittle as they leave the kiln, may be rendered absolutely water tight and much stronger by immersion in a bath of hot tar. Building stones are also greatly improved by similar treatment; and for many purposes the dead black color which results is an advantage rather than an objection. The tar should be deprived of water and its most volatile oils; and to produce good results, the bath must be maintained at a temperature of at least 100° C. The articles to be treated should be thoroughly dried, and allowed to remain in the tar for some time.—*Industries.*

"UNIQUE" SCREW-HOLDING SCREW DRIVER.

Every one using screw drivers has doubtless experienced great difficulty under certain circumstances, and in particular places, in holding the screw until well started, and can well appreciate the tool we illustrate, although it must be seen and used to understand all there is in it. It is made of best steel and tempered in the most careful manner, and the handles are held fast to the blade by a screw through the tang, so the handle

SHOWING CLUTCH HOLDING SCREW.



SHOWING CLUTCH DISENGAGED FROM SCREW.

cannot get loose or the blade put out. The Alford & Berkele Co., 77 Chambers Street, New York City, are the sole agents, and this screw driver is meeting with a rapid sale.

El Anunciador, a Spanish monthly, published by The Dumont Co., New York, and devoted to the interests of American manufacturers, deserves honorable mention.

Though published but two years, yet by its large and carefully selected circulation in Mexico, Central and South America, and the West Indies, it has secured valuable business for its patrons.

Manufacturers who are seeking increased trade in those countries should not hesitate to give it their support.

The Wooden Railways of the United States.

The *Northwestern Lumberman* gives the following table of the various logging railways of this country:

	Number of roads.	Number of miles.	Number of miles standard gauge.	Number of miles narrow gauge.	Number of locomotives.	Number of cars.
Alabama	28	146	36	64	27	250
Arkansas	28	104	83½	61½	23	215
California	23	114	72	80½	40	549
Florida	15	176	85	35	18	203
Georgia	32	225	132½	2	61	244
Kentucky	4	44	50	4¼	7	177
Louisiana	9	35	2	19	9	67
Maryland	1	13	.....	18	2	12
Michigan	54	283	128	225½	60	1,370
Minnesota	1	3	5	.....	1	9
Mississippi	15	65	21½	31	15	189
Missouri	7	31	21	12	7	93
Nevada	2	8	.....	8	2	9
New Hampshire	3	19	26	.....	7	134
New York	4	9	6	.....	2	20
North Carolina	8	117	6	4	9	123
Ohio	5	18	5	12	3	36
Oregon	3	7	4	4	1	28
Pennsylvania	44	168	123	51	36	444
South Carolina	16	170	99	25	20	124
Tennessee	7	51	.....	51	4	80
Texas	35	153	.....	153	36	296
Utah	1	2	.....	.....	.....	4
Vermont	1	4	4	.....	1	15
Virginia	7	126	.....	107½	13	284
Washington Terr.	18	109	56½	27	12	114
West Virginia	5	32	7	8½	3	48
Wisconsin	7	56	38	2	9	95
Totals	383	2,288	1,011	1,001	428	5,182

These roads for the most part are made of wood, consisting of longitudinal poles or timbers, and the cars and locomotives that run on them are provided with grooved or double-flanged wheels. They are the cheapest form of railway. The estimated aggregate amount invested in these roads is close on to twelve millions of dollars, itemized as follows:

428 locomotives at $4,000	$1,712,000
5,182 cars, at $150	777,300
2,288 miles roadbed and track, at $4,000	9,152,000
Total	$11,641,300

Prevention of Fire in Theaters.

A new theater was opened recently at Odessa, in which special precautions have been taken for safety from fire. The auditorium, which accommodates 1,800 people, can be entirely separated from the stage by an iron curtain which can be lowered in from fifteen to twenty seconds. The auditorium is heated by hot air, and the remainder of the building by hot water. The theater is entirely lighted by electricity, the dynamos and engines being situated a mile distant. Water is laid on all over the theater. In the lower parts it is supplied direct from the town reservoirs, and in the upper parts from three iron tanks on the roof, which are fed by a steam pump. The stage, which accommodates five hundred people, is not only separated from the auditorium by the iron curtain, but also from the back premises by automatic iron doors leading into fire proof corridors, which in their turn are also separated from the dressing rooms by iron doors. The flooring of the whole building is made of iron.

House Heating.

The E. N. Gates system of heating by hot water circulation is receiving the indorsement of many architects. Its simplicity, positive heating, and economy in fuel commend it to those thinking of home comforts.

Their manufactory has been removed from Springfield to Fitchburg, Mass., where commodious offices and testing rooms have been fitted up to accommodate their rapidly increasing business. They will be pleased to furnish any desired information regarding the heating of buildings by hot water circulation.

The New York Safety Dumb Waiter.

The Edward Storm Spring Co, of Poughkeepsie, N. Y., are meeting with great success in introducing the New York safety dumb waiter. The fixtures are sold by the hardware trade generally, but can be bought direct from the manufacturers. We have called attention heretofore to the excellent qualities of this dumb waiter, and would advise all interested to write for the illustrated pamphlet, which will be sent free to all applicants.

THE "IDEAL"
PATENT TILE-LINED BATH-TUB.
Perfection of Cleanliness and Durability.
SHARPLESS & WATTS, Patentees,
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Fine Office & Bank Fittings BRASS & WIRE WORK.
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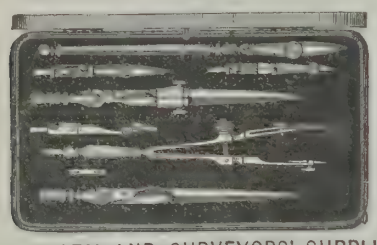

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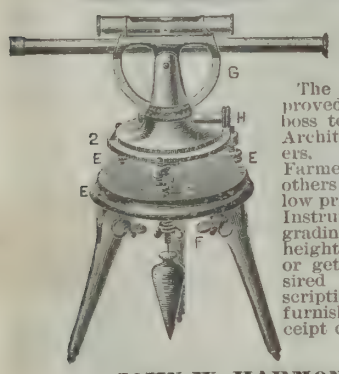

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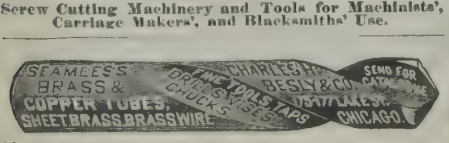

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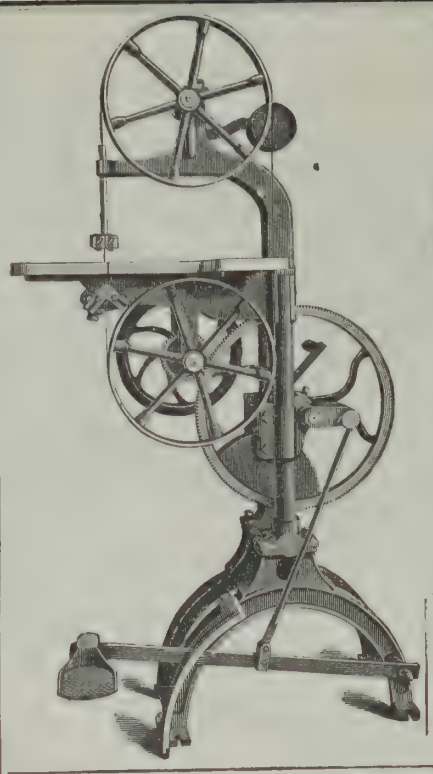

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Read the Following Letters from Builders:
CLARENCE F. LEE, carpenter and builder, Morristown, N. J., says: "I have had one of your Hand Circular Rip-Saws for about three months, and am much pleased with it. Have done the ripping for 15 houses in that time, which is over forty miles through inch boards. Have ripped as high as 3-inch plank. Table is also good for rabbeting; having rabbeted all jambs and sawed all drips for 200 windows."

ALEX. SHIELDS, Lima Ohio, says: "A few days since we had some 150 small drawers to make for a drug store; the steam power mill wanted 50 cents each for making them. With my foot power machinery I made them, and saved $25 above good wages on the job.

If desired, these machines will be sold ON TRIAL.
The purchaser can have ample time to test them in his own shop and on the work he wishes them to do. Descriptive Catalogue and Price List Free.
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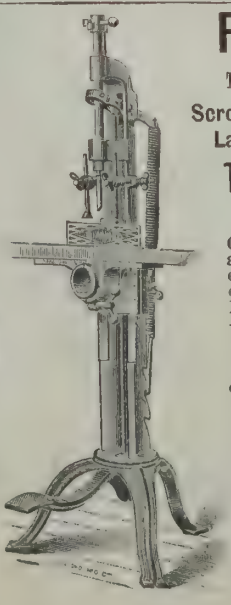
New York Agency. Factory Prices.



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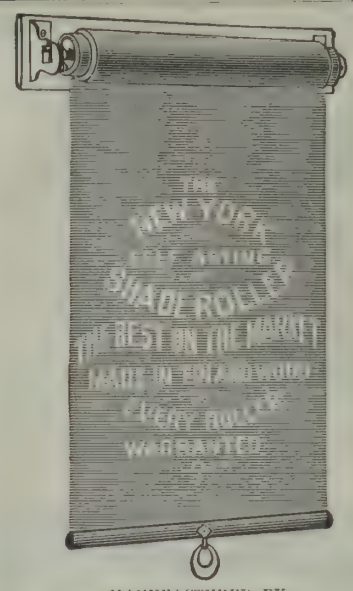

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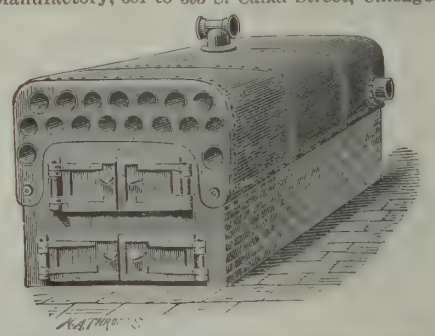

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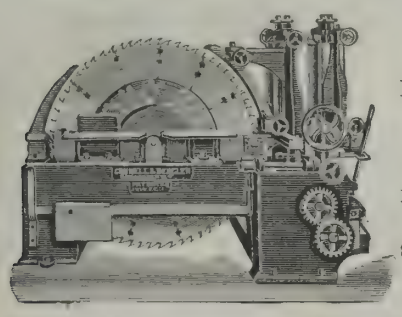

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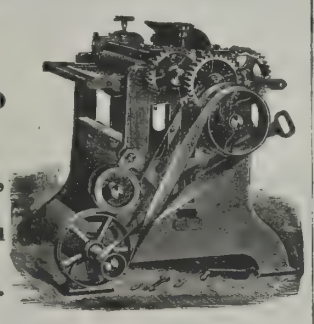

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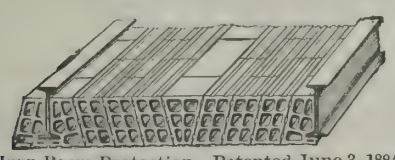

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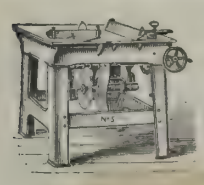

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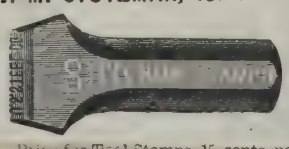

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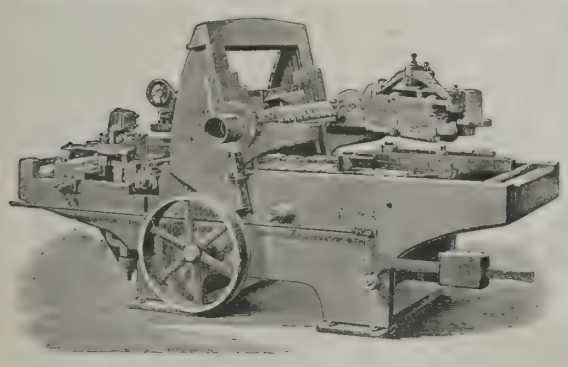

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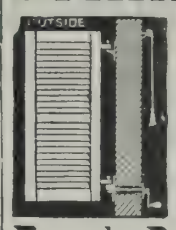

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Incomparable for strength, durability, and power.
Can be applied to old or new houses, of brick, stone, or wood.

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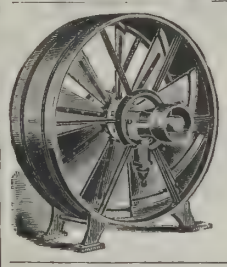

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Capacity Quickly Increased or Diminished.

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The Best and Cheapest Metallic Roofing

TILES AND SHINGLES

YET OFFERED TO THE BUILDING TRADE.

The Horseshoe Spring-Lock Shingle (Patten's Patent) just out. This Shingle can be put on in one-half the time it requires with any other shingle now in the market. Is cheap, durable, secure, thoroughly water-tight and makes a good appearance as a roof covering. Two (2) sizes.

THORN'S PATENT ROOFING and WALL TILES, the most perfect and Unique Roof, Gable, Tower, and Wall covering, yet produced in metal. On the roof in appearance they are like terra cotta earthen tiles, and are better, and half the cost. Four (4) designs or sizes are made.

All the above goods are packed a square to the box and delivered f. o. b. cars in Philadelphia.

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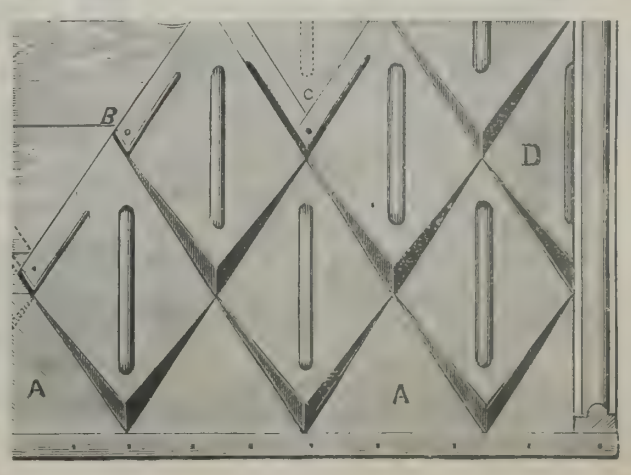

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. E. F.—The drying of sapling timber is difficult under any circumstance. We recommend you to dry it in the bark, and in as long pieces as possible. Put it in a small drying room or steam box and turn steam directly upon the wood, so as to heat it thoroughly. Keep steam on for one or two days. Then turn steam into the drying coil, and keep up the heat with no open steam, in the drying room for a day, when you will find the sap thoroughly cooked and the wood without cracks. Then bark and cut.

(2) A. S. writes: Do you know of any paint that can be applied to posts, that horses will not touch? A. We do not know of any but such as it would be objectionable to use.

(3) C. N. S. desires a recipe for a whitewash suitable for outbuildings on a farm; something that will not rub or wash off, and not injure trees and can be tinted. A. For one barrel of color wash use half a bushel of white lime, three pecks hydraulic cement, ten pounds umber, ten pounds ocher, one pound Venetian red, one-quarter pound lampblack. Slake the lime, cut the lampblack with vinegar, and mix well together, then add the cement and fill the barrel with water. Let it stand twelve hours before using, and stir frequently while putting on. This wash is not a clear white, but a light stone color, which may be more or less changed by the other colors. This covers well, hardens without scaling, and will not wash off.

(4) W. R. H. asks for the best method for polishing furniture made of open grained wood. A. A furniture polish which has been recently recommended is prepared as follows: Melt three or four pieces of sandarac, each of the size of a walnut; add one pint of boiled oil, and boil together for an hour. While cooling add one drachm of Venice turpentine, and if too thick, a little oil of turpentine also. Apply this all over the furniture, and after some hours rub it off; rub the furniture daily, without applying fresh varnish, except about once in two months. Water does not injure this polish, and any stain or scratch may again be covered, which cannot be done with French polish.

(5) W. B R. writes: I have about a ton of tacks slightly rusted. How can I clean them? Sulphuric acid does it, but they rust again before I can dry them. Attrition in a rattler ruins the points. If dried in sawdust, how can I separate them from the same? If with lime, how remove that? They must be clean enough to carry in the mouth, as is the practice of most users of tacks. A. Put the tacks in a wire cloth basket, dip in the sulphuric acid bath and quickly plunge in boiling hot water, then in boiling hot lime water, then throw the tacks upon a wire cloth over a fire to dry quickly. The lime water should only contain as much lime as the water will hold in solution cold. It should not be milky.

(*Continued on page* x.)

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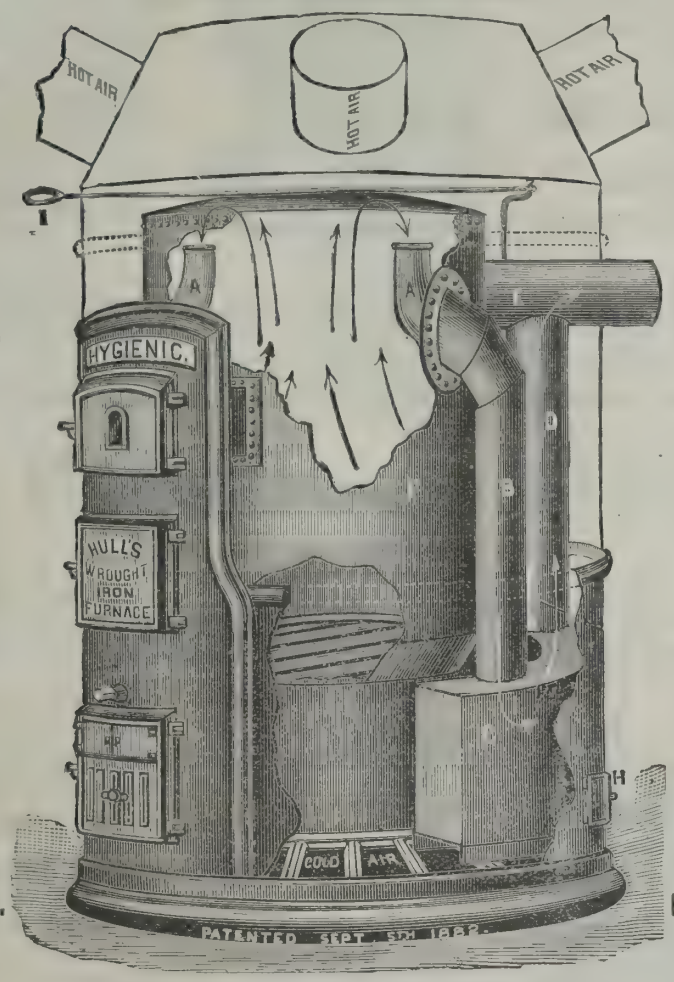

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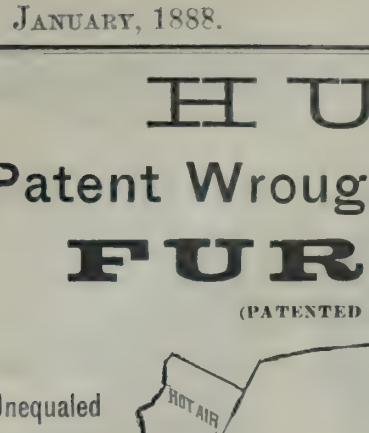

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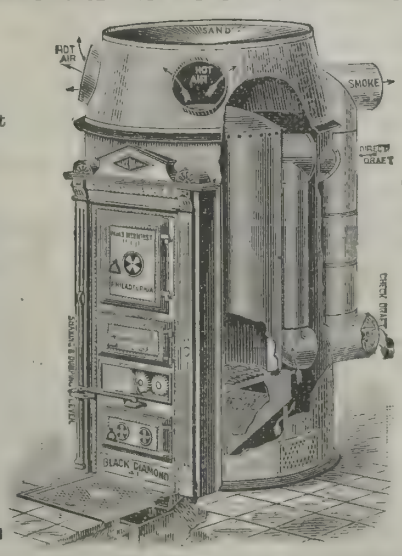

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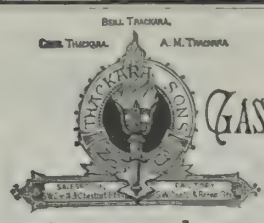

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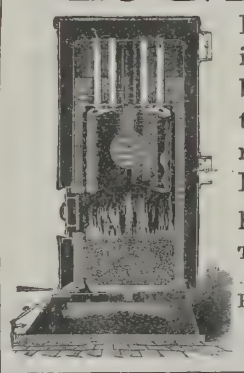

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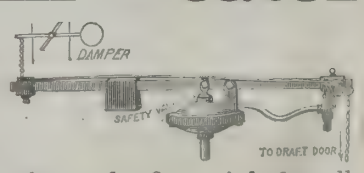

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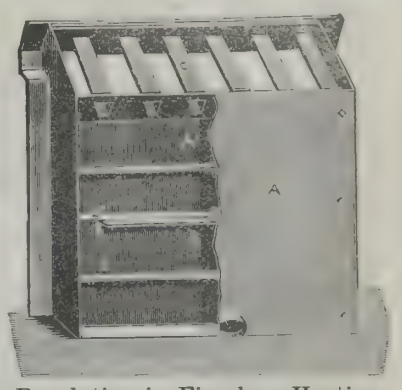

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Notes and Queries.

(*Continued from page* vi.)

(6) E. H. S.—Coal tar alone with gravel and sand for side walks does not dry well. Asphaltum with equal parts of coal tar melted together and sprinkled upon the mixed sand and gravel that has been made hot upon an iron plate (the mixing to be done in a large pan of iron), putting no more asphalt and tar upon the sand and gravel than will just make it stick together; then dump into place while hot, spread quickly, and beat level with a ram or heavy roller. Dust over the surface with fine sand before rolling or beating, to prevent the material from sticking to the roller or beater. This operation requires a little care and experience as to just the amount of asphalt and tar for a given measure of sand and gravel, and also for the proportions of sand and gravel required to make the best pavement. Sometimes a thin bed of broken stone is laid as a foundation. Also a thin bed of coarse gravel is sometimes spread before dumping the hot mixture.

(7) J. B. W.—Hard wood lumber should not be kiln-dried until marketed and ready for use. It is less liable to crack or become shaky after being cut to required size for use. Wagon and car builders have their own kilns, heated by steam, which is essential for perfect kiln drying. Such a plant may cost from one to two thousand dollars. We recommend you to correspond with lumber dealers in regard to establishing a trade.

(8) P. S. M. asks the average amount of square plate or pipe surface used in practice for heating 1,000 cubic feet of room space in buildings by hot water or low pressure steam, say 5 pounds, and the same for high pressure steam. A. 10 to 12 square feet per 1,000 cubic for hot water, 7 to 9 square feet per 1,000 cubic feet for low pressure according to exposure, and 6 to 7 square feet per 1,000 cubic feet for high pressure.

(9) W. W.—The telescopes of surveying instruments, except in some special cases, are the same as the ordinary terrestrial telescopes or spyglasses in their optical construction. It is necessary that the crosswires be put exactly in the focus of both object glass and eyepiece. Their magnifying power is from 10 to 25 times. Orifice at eye end three-sixteenths to one-quarter inch. Bright brass castings cost in New York 20 to 30 cents per pound, according to quality.

(10) J. J. R. writes: What will soften the water in our well, and still leave it fit for drinking and cooking purposes? The water is very hard, and it is as much as we can do to wash with it. A. By adding lime to the water, and allowing the mixture to stand for 24 hours and then filtering, the condition of the water will be improved. See the article on "How to Soften Hard Water," Scientific American Supplement, 270.

(11) J. H. A. asks: What is the cause of putty losing its color and turning white in the joints of bricks? A. Venetian red contains but a slight amount of oxide of iron, so that the putty made from such a pigment is not likely to contain over 5 per cent of the coloring matter. Good putty made with chemically pure oxide of iron will not lose its color. There is no destruction of coloring matter, simply the putty, unless properly made, does not contain sufficient pigment.

(12) J. J. R. writes: I have a large tank (circular) which I wish to coat with something before I let in the water. Material, white pine. What can I use to keep the water from penetrating the wood and that will not injure the water for family use? A. We know of nothing better for painting wooden tanks than Price's metallic paint (red oxide of iron) and boiled linseed oil, 2 good coats, first well dried before the second is put on. The best coating for a wooden tank for drinking water is paraffine, which can be put on the wood with a warm iron, such as a sad iron or tailor's goose heated about 250°.

(13) J. T. B.—There will be very little difference in your house with a 4 inch air space and a 1 inch air space as to warmth or dryness. A 2 inch space is preferable. Your 4 inch outside wall is very objectionable; it has no stability of itself, and the means of tying it to the terra cotta lining are limited and not reliable. A cheaper and better way is to build your house with substantial walls, 8 inches or 12 inches thick, according to size and height, and fur off the outer walls and lath and plaster.

(14) A. C. F. asks about a driven well where the soil is sandy, water being found about 60 feet below the surface; it appears to be in the quicksand, beneath which appears to be clay. In getting water, the sand being fine and mixed with the water passes through the pipe, and is continually drawn up with the water, thus making the water muddy and impure. How can a well be driven under such circumstances so as to make it work well? A. There is no better way of keeping fine sand out of driven well pipes than to make the strainer longer than usual and cover with very fine brass wire cloth, about 60 mesh to the inch. When driven into quicksand, the fine sand that will pass through may be pumped up by working a pump strongly. The larger particles of sand will be drawn against the strainer, and in a short time form a filter stratum around the pipe, which will keep back the quicksand. In this way we have pumped out a half barrel of the fine quicksand, and obtained a clear flow that lasted many years. Sometimes doubling the wire cloth will add much to the durability of the strainer.

(15) S. & T. say: Having a reservoir full of water and a certain size of pipe out of bottom running down a hill, will more water be discharged 200 feet below than will be at 100 feet, say a 1 inch pipe throughout? The question is whether the additional fall will cause the water to enter the 1 inch any faster in the one case than the other. Should not the inlet be larger? A. If lengths between each station are the same, no more water will be discharged at 200 feet than at 100 feet. Make the upper section larger for more flow at the bottom.

(16) A. F. L. asks for the cost of the St. Louis bridge, and also of the Brooklyn bridge. A. The St. Louis bridge cost $6,537,000. Brooklyn bridge cost in round numbers $15,500,000. These amounts include the approaches, but do not include interest. With interest added up to date of completion, the cost of the Brooklyn bridge was about $21,000,000.

(17) J. A. D. writes: About a year ago I built a fence, using three 8 by 8 inch posts, which were supposed to have been seasoned. I primed them with ready mixed white paint, and afterward gave them two coats of white lead (Atlantic) and linseed oil. In a few weeks the paint blistered and cracked off. I sandpapered them and gave them another coat, but the same thing happened again. It has fallen off four times. Can you tell me the cause, and what will stop it? A. Probably the ground is wet, and the posts absorb water. The sun heating the paint may vaporize the water under it sufficiently for blistering. Try covering the parts of the posts underground with tar.

(18) J. D. F. says: 1. I have some old paint brushes which have become hard with paint. How can the paint be removed so as to make the brushes perfectly clean without injury to the bristles? A. To soften brushes that have become hard, soak them 24 hours in raw linseed oil and rinse them out in hot turpentine, repeating the process till clean; or wash them in hot soda and water and soft soap. 2. Can you tell me of something to put on awnings to prevent mildew? A. To remove mildew stains, mix well together two tablespoonfuls of soft soap, one of salt, two of powdered starch, and the juice of a lemon. Lay this mixture on both sides of the stain with a painter's brush, and then lay the articles on the grass, day and night, until the stain disappears.

(19) J. C. H. asks: Is there any cheap method by which asbestos felt can be made waterproof? That is, saturated completely and thus rendered impervious to water? Can this be done and the material still be at all pliable, or will it be rendered stiff? If the felt can be made waterproof in sheets, and boxes or tanks are desired to be made of it, what material should be used to cement the joint seams or corners? A. We think the following would accomplish your purpose. A mixture is prepared consisting of 60 parts of resin, 80 parts of tallow, 5 parts of wax, and 5 parts of turpentine. Soak the asbestos felt in this mixture, and it will become waterproof. Several processes for waterproofing cloth may be found in the Scientific American Supplement, No. 317, which will afford you some information on this subject. This lining cannot be cemented, but only joined by same or similar material. We should think asbestos not a very suitable material for tank lining.

(20) C. W. G. asks (1) for a No. 1 polish for wood. One that will remove specks, and fill up to some extent scratches, etc., and that would polish and dry quickly. A. Gum shellac 3 ounces, gum mastic 1 ounce, gum sandarac 3 ounces, alcohol 40 ounces. Dissolve the last two in the alcohol, then dissolve the shellac and pour off the clear for use. Filling composition consists of size and whiting brought to the consistency of putty. 2. A good zinc polish (fluid) one that will clean and polish quickly and is lasting. A. Use glycerine or creosote mixed with dilute sulphuric acid; hydrochloric acid diluted may also be used. 3. A good fluid for polishing and cleaning the copper drains for glasses used in saloons, they being wet continually, and hard to keep bright. A. Copper can be cleaned by using old nitric acid diluted, or use soft stone and rotten stone, made into a stiff paste with water and dissolved by gently simmering in a water bath. Rub on with a woolen rag and polish with dry whiting and rotten stone. 4. The best plating fluid for silver and nickel, without the battery. A. See answer to query No. 28 in the Scientific American for May 24, 1884.

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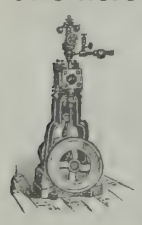

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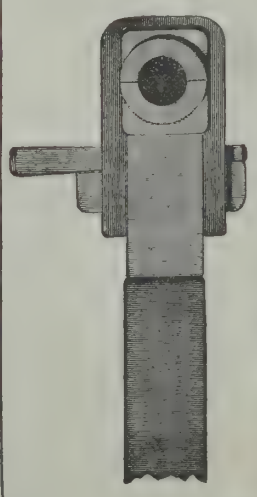

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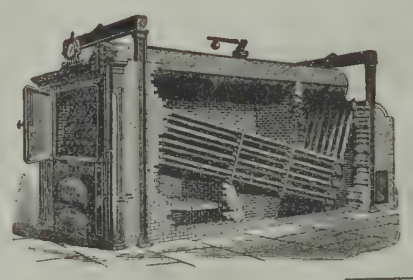

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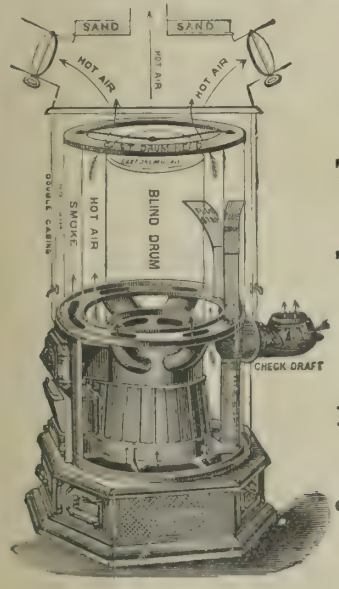

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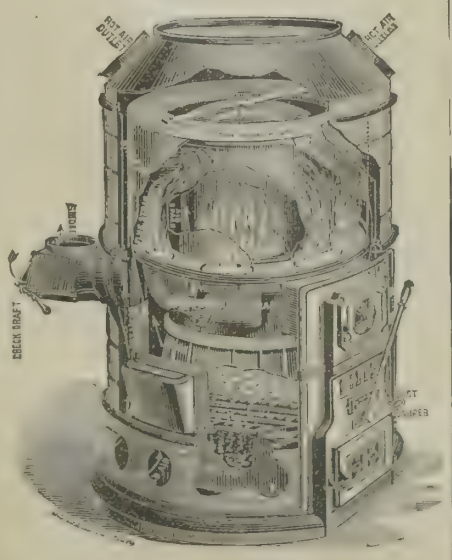

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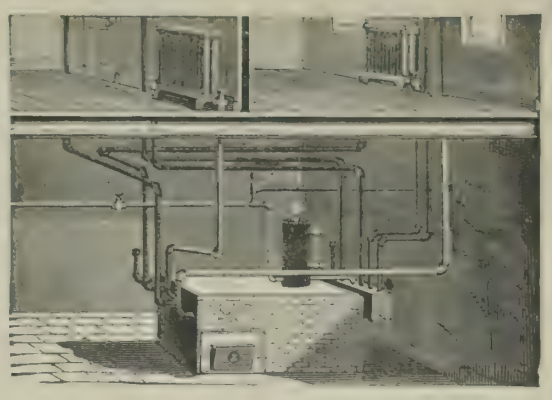

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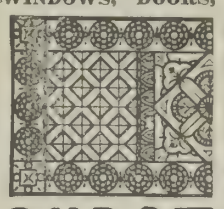

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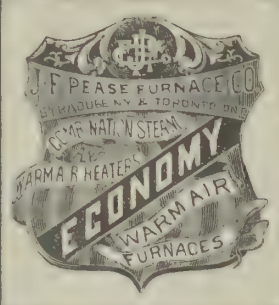

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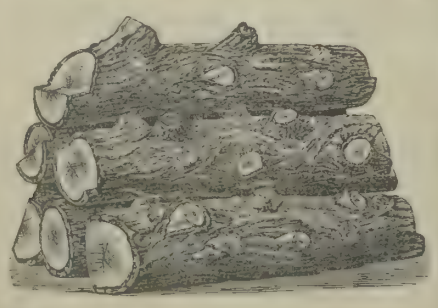

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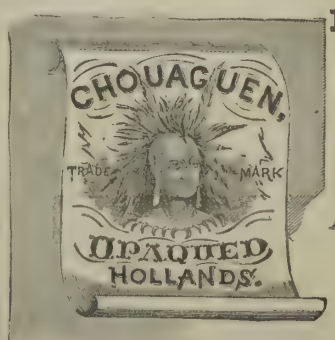

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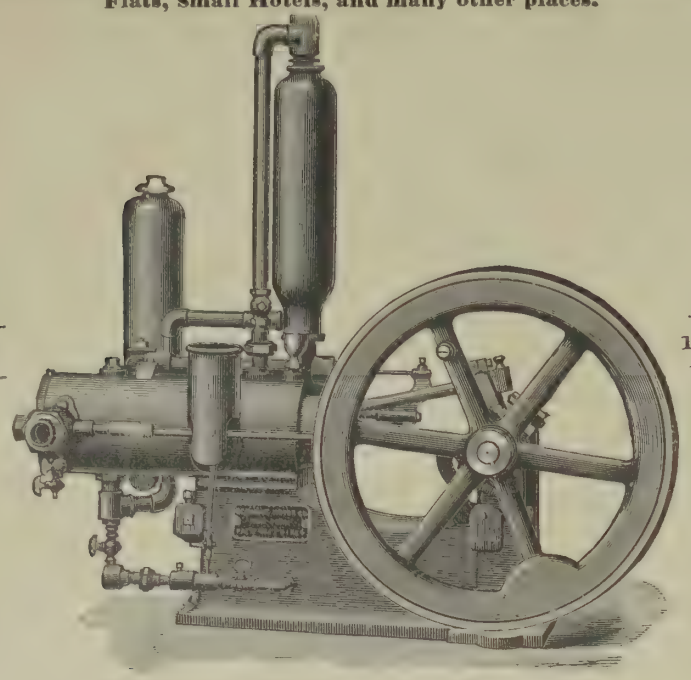

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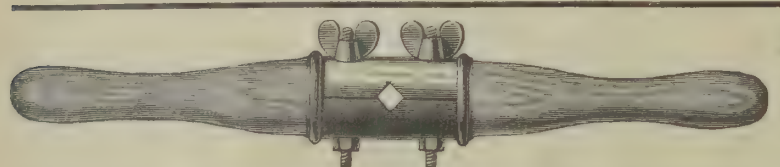

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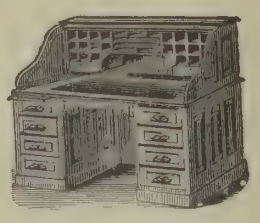

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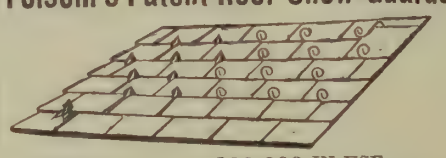

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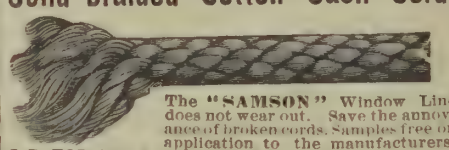

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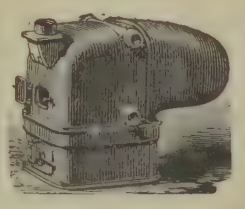

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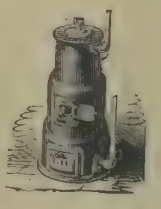

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ARCHITECTS AND BUILDERS EDITION.

Vol. V. Subscription, $2.50 a Year. NEW YORK, FEBRUARY, 1888. Single Copies, 25 Cents. No.

AN APARTMENT HOUSE—GEORGE H. GRIEBEL, ARCHITECT, NEW YORK.

[For description see page 87.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, FEBRUARY, 1888.

THE

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CONTENTS

Of the February number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

OUR PLATES AS AIDS TO BUSINESS.

It has become quite the fashion now for builders to adorn the walls of their offices with the elegant plates in colors given in the SCIENTIFIC AMERICAN. The plates thus presented are not only ornamental, but are great aids to business. When a customer comes in to inquire about building, or to ascertain how would be a good way to arrange this or that part of his house, his attention is at once directed to the plates upon the wall; and by reference to them he is enabled to explain his ideas better, and gain more information in five minute's time than could be brought out in a half-day's pow-wow, if unassisted by the illustrations.

It is now generally admitted among builders that the regular publication of these plates in colors have been to them of great business advantage. They help the builder and customer to decide what they want, and greatly facilitate the making of definite contracts.

Thousands of SCIENTIFIC AMERICAN houses have been erected during the past year in all parts of the country; and it is pleasing to know that in nine cases out of ten they give satisfaction. Where the full plans and specifications we furnish are followed, we think we are safe in saying the house always goes together without a hitch. We have yet to hear of a single instance of failure.

Now, in view of what we are doing for the builder, we would ask him to do one little thing for us, namely, speak a good word for our paper and send us in a new subscriber. The larger our subscription list, the more we shall be enabled to improve our work, and thus all concerned will be benefited.

PLASTERING HOW IT IS APPLIED, FINISHED, AND DECORATED.

A correspondent has requested a description of how walls are plastered in the rough, the colors used and how they are applied. The domain of art into which we are carried by these questions is so broad, and the technique involved is so much a matter of manual skill and training, that it is difficult to make the subject clear without a broader and more detailed treatment than we have space for at present. Some of the best methods in use, therefore, are outlined as follows:

For inside work, plastering is a kind of mortar, varying in its composition according to its intended purpose. In first-class work it consists of three coats. The first or rough coat is made of lime, sand, and hair, usually mixed in the proportion of one or one and one-half of fresh water sand to one of lime, mixed with fresh water and about one-third of a pound of hair to every cubic foot of mortar. The hair should be long, sound, and strong and free from grease or dirt, should be well beaten before use, in order to separate the hairs. Less hair is needed in the walls than in the ceiling. This coat is about three-eighths to one-half inch thick, and should be put on roughly and pressed between the laths by a trowel. After this coat has dried for a day or two, its surface is scratched or pricked up with a pointed stick by lines crossing each other diagonally and from two to four inches apart.

The second coat is put on from one-quarter to three-eighths of an inch thick, using the same coarse stuff as for the first coat. It is applied when the roughened projections of the first coat are dry enough to resist pressure.

It is "floated" in the following manner:

In order to insure the surface of the plaster being in a true plane, narrow bands or "screeds" of plaster, about six or seven inches wide, are formed at the angles and at intervals of from four to ten feet on the wall or ceiling. The surfaces of these are then brought into the required plane by passing long, straight edges over them.

Horizontal screeds for ceilings are leveled, and vertical screeds "plumbed" up from the skirting grounds before the next step. The spaces between the screeds are then "filled" out flush with the fine stuff, and smoothed off with straight edges, or with a large flat board having two handles at the back, and known as a "Derby" float. The surface is then gone over with a smaller hand float, and any defects made good by adding a little soft stuff.

The third or finishing coat is about one-eighth of an inch in thickness and contains no hair. It is composed of one part of lime to two of sand, or it is finished with fine stuff, which should be made of pure lime, slaked with a small quantity of water, sufficient being afterward added to bring it to the consistency of cream. It is then permitted to settle in a tub, the surface water drained off and allowed to evaporate until thick enough for use.

The last coat is formed of gauged stuff, which consists of three-fourths to four-fifths plasterer's putty, *i. e.*, lime dissolved in water and then run through a hair sieve. It is similar to but differently prepared than fine stuff, and used without hair, the remaining ingredient being plaster of Paris The latter must be used in small quantities, its purpose being to hasten the hardening, the proportion depending on the time allowed for setting.

The best finish for a wall surface to be decorated in oil is the first or stucco finish, as it is sometimes called. The final coat is smoothed or polished according to the decorative treatment it is to receive.

Sometimes the finishing coat is of "troweled stucco," which consists of two-thirds fine stuff and one-third sand, and is worked upon the second coat, which must be perfectly dry before it is applied. The stucco is beaten and tempered with water until it is as fluid as thin paste. It is then spread with a large trowel over the surface to the thickness of about one-sixteenth inch, as evenly as possible, and in small portions of about two or three square yards. The surface is then dampened and rubbed down with the hand float, at the same time sprinkling the plaster with a wet brush, until a surface is produced as hard and smooth as that of polished marble.

This does not make as strong a finish as the fine stuff, but is to be preferred for surfaces that are to be painted or ceilings to be finished white.

Sometimes walls are rendered in cement, and the best brands for the purpose are Keene's, Martin's, and the Roman. They are generally laid on in one coat from one-half to three-fourths of an inch, in the proportion of one to one or two of sand, the surface being finished afterward with a thin coat of neat cement.

Keene's is superior to the others in hardness. It can be painted on twenty-four hours after the coat is laid. It will mix with any of the colored metallic oxides without injury to the coloring matter. Martin's has more covering power, and is therefore cheaper, but it requires more skill to use it, and it cannot be mixed with plaster of Paris nor be used in connection with Roman or Portland cement.

Where great rapidity and durability are required at a low cost, interior work may be rendered and set with "selenitic clay."

Finish.—The materials are to be mixed in the proportion of five pails of water, one bushel of prepared selenitic lime, three bushels of prepared selenitic clay, two bushels of fine washed sand, and one hod of chalk lime putty. It must be hand-floated to a fair face and well troweled. It is non absorbent and can be washed. Two-coat work can be finished in twenty-four hours, and ceilings can be floated immediately after the application of the first coat, and be set in forty-eight hours.

Walls may be colored in various ways. The most commonly used are where water or oil is the medium. The first method is generally called distemper, which consists of whiting and size mixed in water. The coloring matter should be ground in water and added to the whiting before it is mixed with the size. The latter should be warm while being incorporated with the color and whiting, and applied to the wall when the jelly-like mass becomes cold.

The best method of mixing it is as follows: Take six pounds of the best whiting and soak it in soft water sufficient to cover it, for several hours. Pour off the water, and stir the whiting into a smooth paste. Strain the material and add one quart of size in the state of jelly. Mix carefully, not breaking the lumps of jelly. Then strain through muslin before using. Leave in a cold place, and the material will become a jelly, which is diluted with water when required for use.

Only two coats are necessary. The first should contain a double quantity of size. Alum and soft soap may be substituted for size. Walls may be distempered and become dry in a day.

Distemper is apt to appear damp in wet weather by absorbing and retaining the dampness of the surrounding atmosphere, and to become spotty in appearance. Unless a house is thoroughly dry and kept well aired, the distemper work is apt to fly and dry out in a patchy manner.

The common colors include lampblack, red and white leads, gray, buff, and stone ochers. Fine colors are chrome yellow, Prussian blue, indigo, burnt sienna, Venetian red, vermilion, Brunswick green, and French green. The same colors may be applied in oil as a medium. Washable distempers may be obtained under the trade names of "Duresco" and "Silicate Zopissa."

Plaster to be painted should be free from air bubbles or "blisters." Both plaster and wall must be perfectly dry before being painted. The best work is obtained by distempering new walls. Allow them to stand for two years, then brush off the distemper without washing, and apply the paint. The plaster may be primed with two or three coats of boiling linseed oil. When this is dry it is covered with a thin coat of weak size, tinged with red lead, to stop all absorption, and give the work a uniform appearance, and then finished off with two coats of oil paint and a "flatting" coat if it is desired to give the wall a dull finish. This coat should be mixed with turpentine only and contain no oil, and the tint should be lighter than the ground color. K.

A REPUBLICATION.

Referring to the colored plate given in our last number (January, 1888), "A Michigan Residence," we should have stated—as probably was noticed by our readers—that the plans and illustrations were simply a republication of the design of Mr. Edward A. Sargent, architect, of this city, which we published just a year ago—January, 1887. The new picture merely shows the house from a different point of view.

TWO DWELLINGS AT ORANGE, N. J.

One of our colored plates this month shows the perspective elevations of two dwellings, which are substantially the same in plan and construction, although a little dissimilar in some of their exterior features. They are estimated to cost about five thousand dollars each; but these figures may be somewhat reduced or increased according to locality or the nature of the interior finish.

We give upon our extra sheet of details quite a number of diagrams which will be readily understood, and hence no long or elaborate description will be necessary.

On the ground floor we have a pleasant veranda of 10′ × 19′, from which we enter a handsome hall 12′ × 12′, with fireplace, parlor and communicating library at the right, both comfortable rooms, main stairway at the left, and dining room, 12′ × 16′, well lighted and opening upon a back piazza. A butler's pantry is arranged between dining room and kitchen. Between the latter and the main hall is a passageway, with back stairs.

The second floor is well arranged, having four comfortable chambers, bath room, ample closet space, etc. The attic is roomy and convenient. These houses have been designed by Mr. Edward A. Sargent, architect, 55 Broadway, New York.

A HOUSE IN THE COLONIAL STYLE.

This design, represented in our colored plate, is one of moderate cost, to suit the average requirement of a gentleman doing business in the city, who chooses to have his family reside in one of our numerous suburbs.

The material for basement is brick or stone, while the superstructure is of timber construction.

The living portion of first story will have double floors with thick felt paper between; the upper boarding, which is of narrow Southern pine, to be laid after the house is trimmed and mantels set.

By this means the floor can be put down in a fresh condition, and then oiled or varnished, the coarse work being done on the rough or under floor, while the building is in progress.

The dining room, hall, and parlor, including vestibule and staircase, are trimmed in hardwood, while the remaining portion is of clear white pine, treated in a natural state, with wood filler and hard oil finish.

The exterior, which is of the Colonial type, has the walls and roof covered with shingles, the wall shingles being of a light yellow, while the trimmings, including sash, are painted white, and outside blinds of olive.

The first floor, under main stair landing, is sunken, so that a gentleman's lavatory can be had here by passing down a few steps to basement landing.

The servants' staircase is somewhat novel, being composed of but seven steps. This being a little steeper than the main stairs brings us up to a level with the main landing. This, to prevent odors, is inclosed, and has a door top and bottom, the former being so retired within the alcove that it is scarcely visible from the main hall.

From kitchen pantry there is an outside refrigerator. This is arranged so as to receive the ice from rear porch, by which means the intrusion of the iceman is avoided, while the refrigerator has access from the pantry.

There is a screen across the end of main hall, with two columns forming an arch in center, the right hand post acting as a newel for main staircase, and the spaces at sides may be filled in with spindle work, screening, in a measure, both stairs and hat rack.

There are four good-sized bed rooms on second story, together with bath room, linen closet, maid's closet, etc.

The attic contains three bed rooms and place for storage.

This house, with some important changes, is now being erected in New Jersey, at a cost of about $5,500, by H. Hudson Holly, architect, of 111 Broadway, New York.

The Doorway of San Petronio at Bologna.

The most recent addition to the architectural court at the South Kensington Museum is a plaster cast of the central western doorway of San Petronio at Bologna. This church is a favorable example of the red brick Gothic architecture of Northern Italy. It is the largest edifice of the kind in Bologna; but even in its present extent it is little more than half the length originally intended—385 ft., as against 750 ft. in the first design. The church was founded in 1390, in honor of San Petronio, the first bishop, and the great doorway was executed by Jacopo della Quercia, in 1425; the architect of the building was Antonio Vincenzi. The vast size of this doorway has needed all the available wall space in the great architectural court, and the work forms a fitting pendant to the "Puerta della Gloria" of Santiago di Compostella, the famous portal of Mateo, on the other side of the court.

Surrounding the arch from San Petronio are 32 half figures of patriarchs and prophets, and on the imposts carried across beneath the arch are statues in full relief of the Virgin and Child, San Petronio, and San Ambrozio. In the arcbitrave are five subjects from the New Testament, treated as bass reliefs, and a similar number of subjects from the Old Testament, from the creation to the deluge, occupy the pilasters on either side. Vasari tells us that the artist devoted twelve years to the execution of this work, and that its completion filled the Bolognese with astonishment. The proportions of this magnificent doorway are somewhat marred by the scale of the plinth mouldings, which are carried across all the lines of the arch, and which, though well adapted to the entire facade, seem unwieldy when taken in connection with the entrance above. Moreover, the great height of the arch renders it a matter of difficulty to examine the figures of the Virgin and Child, and companion saints, and the fine bass reliefs in the frieze. It is said that Della Quercia has introduced his own portrait among the patriarchs, and that the figure in the archivolt wearing a chaplet of oak leaves is the one in question. This splendid piece of casting has been executed for the museum by Lelli, of Florence, at a cost of £875, which compares very favorably with Brucciani's work at Santiago, which cost the government £2,300.—*Building News.*

Brick as a Building Material.*

BY PROF. R. T. BROWN.

Primitive man probably occupied a semi-tropical climate, where he needed but little protection from cold, and a tent made of the skins of animals served to protect him from other inclemencies of weather. When his migrations carried him further into the temperate zones, he at first would naturally seek protection from the cold in caves among the rocks. This would probably lead him to the construction of artificial dwellings of the same material. But many broad and fertile plains and valleys existed which afforded good hunting ground and rich pasturage, were stone could not be procured to construct even a mud hut, and without metal tools the construction with wood would be both laborious and tedious.

The obvious resort would be to clay at first, no doubt, in the form of sun-baked adobes, but later as the earliest historic record has it, they burned them thoroughly, and had brick as a substitute for stone. The almost universal distribution of clay in almost every inhabitable country would naturally lead to its early use as a building material. Its use was, no doubt, more general in the prehistoric age than we have any visible evidence of to-day. Wood was the only known fuel for burning brick, and to prepare it without the aid of metal tools was a difficult task, which would be undertaken only on special occasions.

Ordinarily, structures for various purposes would be made of sun-dried clay, which, except in rainless regions, would in time return to its original condition. It is not at all improbable that the mounds which remain as footprints of a prehistoric race that once inhabited this country were originally built with adobe. A true prehistoric mound is always built of clay, though the ground on which it stands may consist of sand or gravel That would require the transportation of clay from a distance.

We are, just now, in this country passing through an era of wooden buildings, and present indications suggest that this age is rapidly nearing its close, from necessity, if not from choice. The enormous consumption of wood in the various demands of our modern civilization will soon render that article too expensive to be used in ordinary buildings. For floors and other joiner work wood will continue to be used, but for walls and roofs some less expensive and more durable material must be substituted.

GENERAL PROPERTIES OF BRICK.

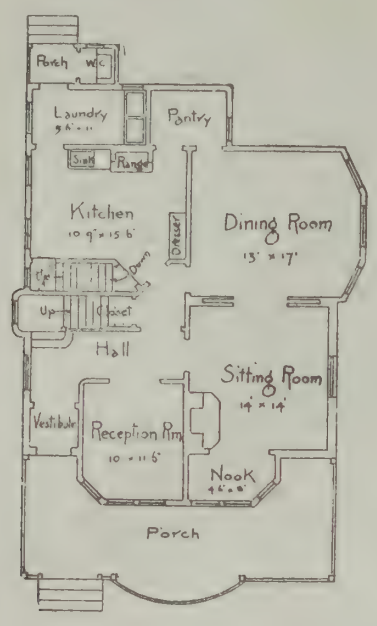
That brick will be the building material in general use in the coming age, we infer: (1) Because of its durability. We may have stone that will be as durable in a building as well burned brick, but it is rare, and but few architects have acquired the skill of selecting it. If we walk around the city and examine the buildings that were constructed fifty years ago, we will find the brick in a much better state of preservation than the stone. Moreover, the brick of that period generally fell below even a medium quality, while most of the stone was from quarries that are yet regarded as furnishing a superior building material. Brick made of good clay, and well burned, is practically indestructible, except by a force that will crush it into fragments. It is proof against all chemical agents, and although it absorbs water quite freely, yet it has sufficient elasticity to endure expansion in freezing without injury. All its component parts being perfectly insoluble, it will remain under water indefinitely without injury, and no degree of heat will affect it that will not fuse iron and destroy granite. The durability of brick walls is very much affected by the character of the mortar used in laying the brick, and in the condition of the brick when laid. Clean, sharp sand, and rather coarse, should be used for mortar, and the lime should be water-slaked, and fresh. Mortar is sometimes weakened by the use of too great a proportion of lime, used with the intention of making it strong. If the brick is laid dry, the mortar will be robbed of its water the moment it touches the brick, and will fail to harden and form a cement. A good brick wall should break anywhere else as soon as between the bricks. In inspecting the old walls, we have observed that the first sign of decay is in the mortar forming the joints. The mortar should be as hard as the brick. (2) In order to maintain as uniform a temperature as possible in a building, it is important that its walls should be composed of material with a low conducting power with regard to heat and a good capacity to retain its temperature uniformly. In these respects no building material excels well burned brick. A house with a brick wall twelve inches thick, even without an air chamber, is easier kept uniformly warm in winter and cool in summer than with a wall of any other durable material; and if an air chamber is introduced between the inner and outer walls, its capacity in both these directions will be increased. Complaints are sometimes made of the dampness of brick walls, but this is always the fault of bad material or of bad construction. Brick imperfectly burned will absorb much water, and will retain it long, but if the outside of the wall be made of hard burned brick, no amount of rain will so wet it as to transmit moisture to the inner surface. The ascent of dampness from the foundation by capillary attraction may always be prevented by interposing a layer of roofing slates between two courses of brick about the level of the lower floor. In cold weather, if fire is occasionally kindled in a room, water will frequently condense on the cold wall from the contact of warm, moist air with it. This may be prevented by keeping the doors closed till the surface of the wall begins to warm up. In occupied rooms which are warmed daily there is seldom any complaint of dampness in brick walls. (3) Building material should not only be such as to make durable and comfortable walls, but we owe something to good taste. Houses should have a cheerful and comely appearance, without the addition of much artificial ornament. This can be secured in a brick wall more readily than in one of any other material. If care be taken in the selection of clay, and especially in the choice of moulding sand, brick of a uniform color may be obtained, and with proper selection of front brick a wall may be made that will be elegant in its very simplicity. If desired, openings may be trimmed with brick of a different shade, to suit the taste of the proprietor. We confess an admiration for the plain brick walls of Philadelphia, that were built 200 years ago, of imported brick, by the Quaker founders of that city of "brotherly love." They promise to endure for centuries yet. (4) A building material should be so abundant as to be inexhaustible and so distributed as to be accessible to every one, and yet be easily worked as to require no high degree of artistic skill to put it into such a form as to be fit for the builder's use. No substance fills all these indications so perfectly as does clay, and this points to brick in some form or mode of manufacture as the future building material of civilized man everywhere—in country and in city. Though brick is among the oldest products of human industry, yet its manufacture is in its infancy. It is scarcely a century since any other power than human muscles was used in preparing clay for a wall; and when we see the effect of the application of steam power in the manufacture of other articles, in reducing the cost of the product, we very naturally anticipate the time when brick will be the cheapest, as it is the best, building material, and will, in consequence, be in universal use. Brick is destined to be a commercial article, and to this end, manufactories on a large scale must be established, and varieties both in form and color will be introduced to accommodate the various tastes of builders. The recent development of natural gas as a cheap source of power for manufacturing and of fuel for burning will invite the attention of enterprise and capital to this field, which promises so much in wealth to the manufacturer and in comfort to the masses.

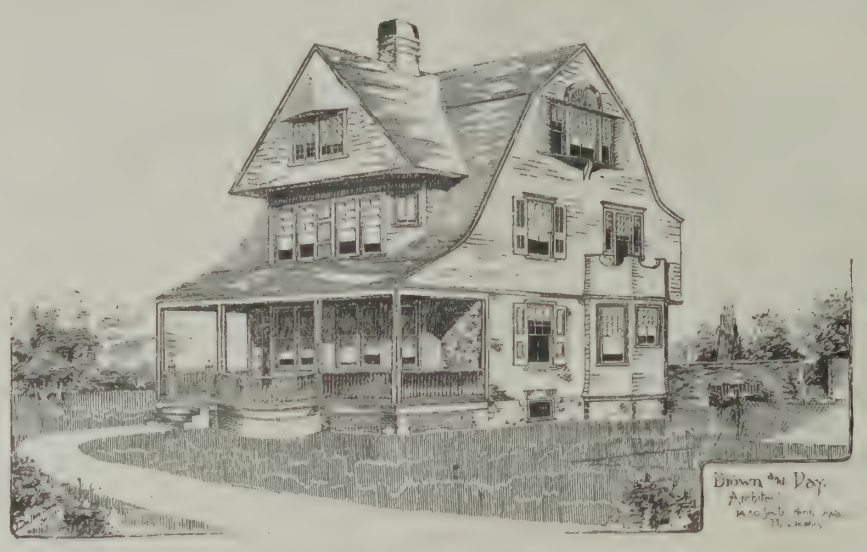
* A paper read before the recent National Brick Manufacturers' Association.

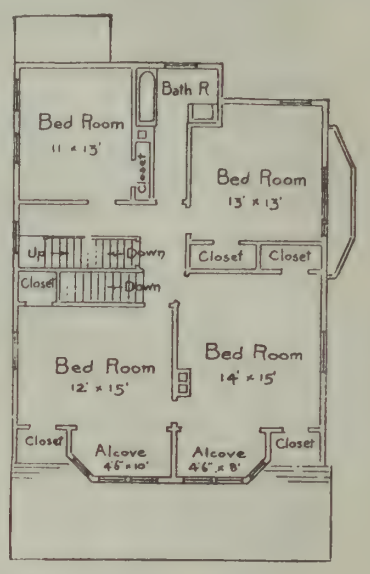
GLASS blowing is an art nearly 4,000 years old, and perhaps much older. Yet there has never been any means discovered of dispensing with the human lungs as the instruments of the blowing. An English company is experimenting with a mould and mechanical bellows, which does satisfactory work at bottle blowing, but this pretends to attempt only coarse work.

A DWELLING OF MODERATE COST.

This design has been prepared by Brown & Day, architects, Philadelphia, Pa., for one of the suburban towns near that city, and is intended to go on a lot containing about half an acre. The first story front is to be built of rough foundry bricks, laid in brown cement. The remainder of the house will be frame, covered with shingles stained with creosote stains in rich, warm tints. The interior will be finished in hard woods and white pine, stained and varnished, the varnish being rubbed to a dull gloss. A special feature has been made of the sitting room, the "nook" forming a very cozy corner to smoke a cigar after Sunday's dinner, or for *materfamilias* to sit with her work basket while darning the weekly batch of stockings. The laundry answers at the same time for a shed kitchen, the tubs forming a convenient table when the lids are closed. The position of the bath room concentrates the plumbing, and makes good work less expensive than if it were some distance from the kitchen. Besides the four bedrooms in the second story, there are two large bedrooms and a store closet in the third story. The closets throughout the house are plenty, and large enough to suit the most exacting housewife. The cost of the house is from $3,800 to $4,200, depending on locality and interior finish. The above, together with engravings, are from the *Builder and Woodworker*, to which we are also indebted for the illustrations of the residence at Latrobe, Pa., and a house at Pittsburg, Pa., by C. M. Bartberger, architect, of that city.







A DWELLING OF MODERATE COST.

How I Build an Ice House.

Place the sills on posts or piers of brick or stone a foot and a half above surface of ground, the posts or piers set in the ground below frost. This will afford free ventilation and drainage (very essential features) underneath. Use 2 by 6 or 2 by 8 studding (according to size of house) with girths so as to board up and down with common rough, but sound boards of even width (for look's sake), rough boards being better than planed ones, as they retain the whitewash longer. Batten with same class of material, four inches wide; line inside crosswise with cheaper material. For floor, use round poles or timbers (placed far enough apart to admit of drainage) with posts or piers underneath them, sufficient to sustain the amount of ice to be stored. On top of the poles place hemlock or spruce boughs, brush, etc., 6 or 8 inches thick, then a layer of straw at least a foot thick, then a layer of sawdust 12 or 15 inches thick. This will exclude the air from underneath, and at same time afford drainage. Pack the ice 20 inches from the side of the house and fill in the space between the ice and house with sawdust, as you fill the house. Fill the spaces between the blocks of ice with smaller pieces, well rammed in. When full, cover with a foot and a half of sawdust, giving all the ventilation possible on top, underneath the roof; in fact, if the gables could be left entirely open, the better, but the rays of the sun and the rain must be excluded. Whitewash the entire house outside with one or two good coats. The whitewash will reflect the heat, while weather-beaten boards or dark paint will absorb it. The whitewash (not yellow) is very essential, as well as is the free circulation of air both on top and underneath. The more rapidly the air passes underneath and over the top, the more rapid the evaporation, and the more rapid the evaporation, the cooler it is.

Place doors at convenient distances up and down for filling and removing the ice and securing and lining the same as the body of the house inside. Do not plan an ice house or build it so as to place the floor directly upon the ground, for the warmth of the ground from the outside will be conducted underneath the ice and *surely* melt at the bottom. I would not advise building into the side of a hill for convenience of filling. A light portable or permanent runway, for hauling up the ice, is not expensive. Upright scantling, firmly spiked or bolted to the house each side of the doors, with a scantling across at the bottom of the doors, firmly bolted to the uprights for the top of the runway to rest upon, so as to be raised to the next door above as the house is filled, is better.

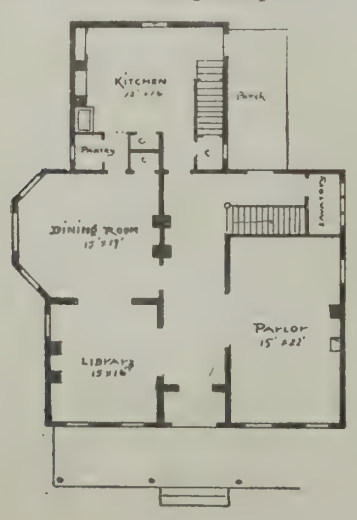
Another plan for the outside, which renders the keeping qualities more perfect and makes a better looking house, is to use, in this case, 2 by 6 studding board outside, diagonally or crosswise, and line as in other case. Then, instead of battens, use 3 inch furring up and down and clapboard, leaving the space under the clapboard or siding open both at top and bottom. This will keep a current of air passing continually up, driving out the warm air that may be generated by the sun through the siding. A like space under the shingles is not needed, as the gables may be left open, if the ends are made to project sufficiently to protect from storm and sun. By allowing the eaves to project sufficiently, a space of 12 or 14 inches could be left open, and with a ventilator in the center, at the ridge pole, and a space open at each, would afford good ventilation.—*S. A. W., Country Gentleman.*

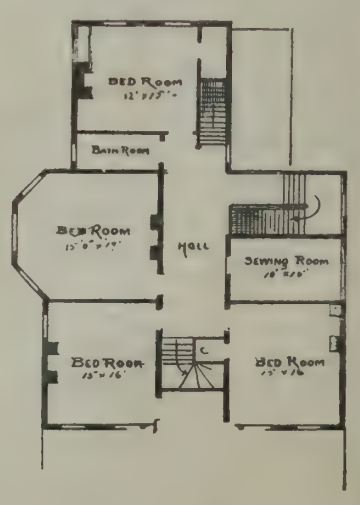
A RESIDENCE AT LATROBE, PA.

Fireproofing Wood.

A mode of rendering wood incombustible not generally known is described as follows: Soak 27·5 parts by weight of sulphate of zinc, 11 of potash, 22 of alum, and 11 of manganic oxide in lukewarm water in an iron boiler, and gradually add 11 parts by weight of 60 per cent. sulphuric acid. The wood to be prepared is placed upon an iron grating in an apparatus of suitable size, the separate pieces being placed at least an inch apart. The liquid is then poured into the apparatus and the wood allowed to remain completely covered for three hours, and it is then air-dried.

The mode of application described is, we fear, a serious obstacle to the general use of this process for timber employed in building. If joists, ceiling beams, and all joinery exposed to fire could be treated after being fixed with some chemical solution of proved resistance to the action of flame, we believe many architects would be found to employ it.





A RESIDENCE AT PITTSBURG, PA.

A SUBURBAN RESIDENCE.

We present herewith a perspective and two floor plans of a very pleasing residence erected near this city from the designs of S. W. Whittemore, architect, of Brick Church. N J.

The building has a front of 43' 6", not including piazza. Side, 74, not including piazza. For size of rooms see floor plans. The height of the stories is: Cellar, 7' 6". First story, 10' 9". Second story, 9' 8". Third story, 8' 6". The foundation is of stone. First story, stone. Second story and gables shingled. Roof shingled. The cost without mantels and heater is estimated at $16,000.

There are open fireplaces in dining room, hall, parlor, library, and three chambers on second floor. Access to all rooms from hall. Conservatory off library. Cellar under the whole house. Three finished bed rooms and hall in attic.

First Story Plan

Second Story

A SUBURBAN RESIDENCE.

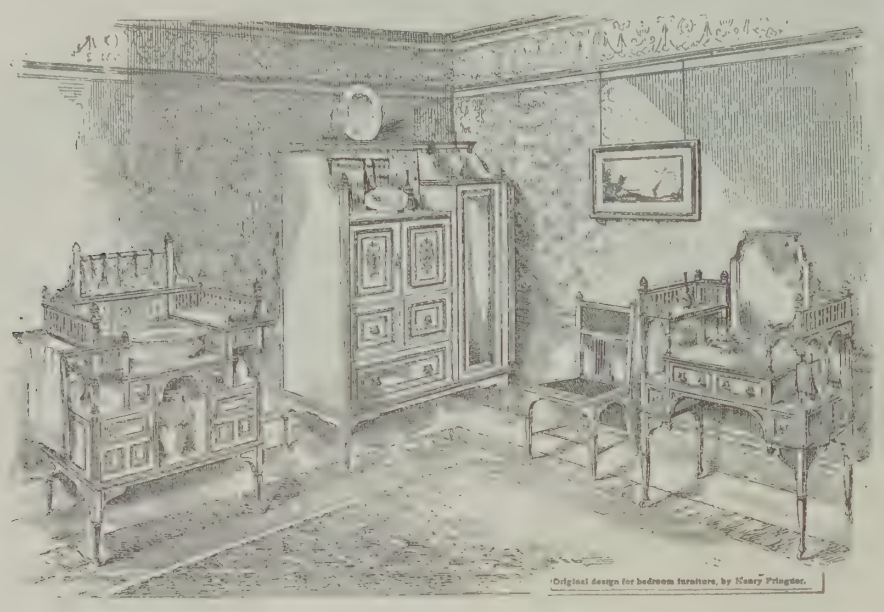
Flow of Water through Pipes.

An agricultural engineer writes, in reply to a correspondent of the *Country Gentleman*, some facts from his experience concerning the flow of water in small pipes, which are interesting. He says: "In answer to the question put by R. M. S., I should reply that a pipe of 1½ inches diameter, and 1,100 yards long, could not be expected to deliver more than half an inch of water with only 20 feet of fall, unless the pipe is laid perfectly graded and on boards, to prevent the retarding influence of the collection of air in the vertical bends of the pipe. The retarding effects of friction in the passage of water through pipes are very great, and in small, long pipes may wholly overcome the flow. I have known a smooth lead half inch pipe, 2 500 feet long, to discharge only a few drops in a minute when the fall was over 40 feet. If the pipe is very smooth inside, the discharge may be as above mentioned; and if otherwise, it may be less There is no other branch of engineering which sets formulas and theories at defiance so much as carrying water through small pipes and low falls. I would advise R. M. S. to lay his pipe of 2 inch diameter for the upper 2,000 feet, and of 1½ for the other and lower 1,300 feet, if he wants a copious flow of water. If the pipe should be a wooden one, I would have it 3 inches all the way through. In

so low a fall as 20 feet in 1,100 yards, equal to two-thirds of a mile, the flow will be quite slow, and the friction will be reduced to a minimum as regards its dependence upon velocity; but it will still be quite large, for the adhesion of the water to the surface will have a considerable retarding effect."

DESIGNS FOR FURNITURE.

We give from the *Cabinet Maker* some designs by Henry Pringüer: "The bedroom suite we publish this month as a suggestion to all those concerned in this branch of the trade is original and novel in character. The idea of building up the sides of the dressing table and washstand in the manner indicated forms a striking and effective feature. By such an arrangement, a firm support for the toilet glass is obtained, of a more stable character than the ordinary arm and jewel box foundation generally employed. The wardrobe



DESIGNS FOR FURNITURE.

door, as previously suggested, is placed at the side of the article. In the front place usually allotted to the door is fixed the traditional sheet of plate glass. By this arrangement it will be obvious to our readers that the door itself is altogether saved the wear and tear usually occasioned by that unwieldy appendage. The door in the present instance should consist of a plain wood panel, which would be more kindly to the hinges, and more easily manipulated. There is enough suggestive detail in this design to form the basis of a salable and effective suite."

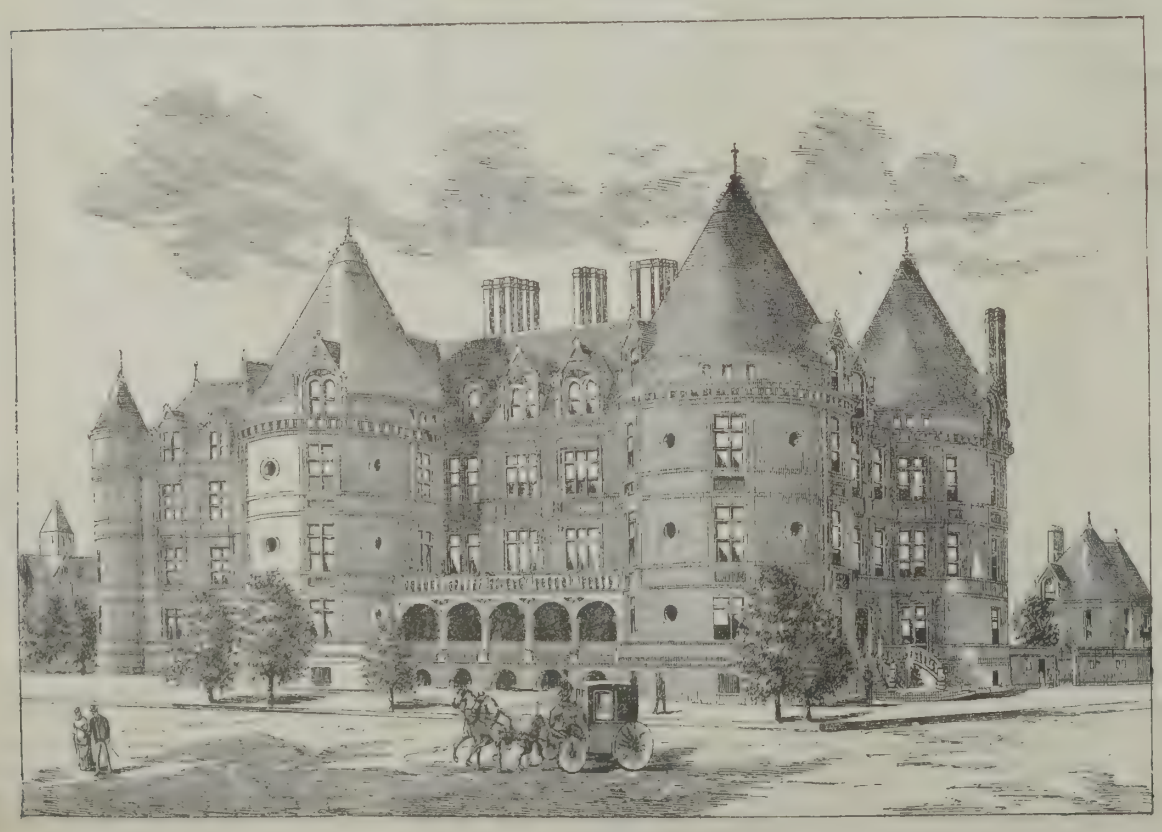
THE NEW CANCER HOSPITAL, NEW YORK.

The New York Cancer Hospital, at 105th Street and Eighth Avenue, New York, has lately been opened for the reception of patients. The building was begun in the spring of 1884, and the main part is now completed. It occupies the northeastern part of the lot, and is in the form of a rectangle, about 100 by 50 feet, with a round tower, 40 feet in diameter, standing out from each of the three corners next the streets. The building is the gift of John Jacob Astor, and he and Mrs. Elizabeth Hamilton Cullum are distinguished as the founders of the hospital, a title obtained by the gift of $50,000 or more at one time. Mrs. Robert L. Stuart and Mrs. Charles Rogers are patrons by subscription, by the gift of $10,000 or more. Givers of endowed beds in perpetuity, by the gift of $5,000, are John E. Parsons, Joseph W. Drexel, Morris K. Jesup, Mrs. Charles Rogers, William Astor, Mrs. C. P. Huntington, Mrs. John Jacob Astor, and Mrs. Cullum.

The situation of the new hospital is as pleasant and in every way desirable as any that could be chosen, facing Central Park, and commanding a fine view of the northern part of the city, and the building itself would much more readily be taken for an art museum than for a hospital. The architect, C. C. Haight, deserves much credit for designing a beautiful as well as a thoroughly useful structure. The present edifice is to accommodate women only, and an addition for the use of men will be made at the southwest corner.

The round towers stand boldly out from the building. In the southeast one are private rooms for patients. The second floor of another of the towers is occupied by more private rooms, and the same floor of the other two by wards, but not such wards as any American hospital has ever known before. As they are in the towers they are necessarily circular, and the beds, eleven in each, are arranged around them like the spokes of a wheel, while the hub is represented by a large ventilation shaft in the center.

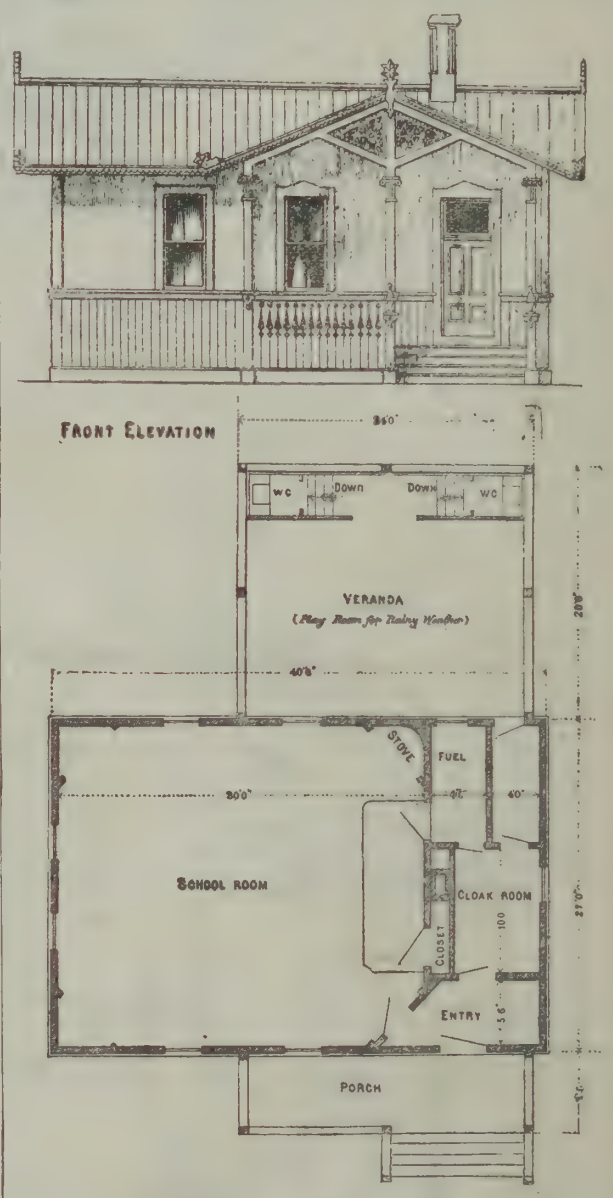
The private rooms are for such patients as have means to pay for them, and also for such as, from the nature of their cases, need to be separated from the others, whether they have means or not. In fact, though a small sum for board will be charged to all who can pay, patients will be received quite as readily who can pay less than the regular rate, or even nothing at all. The wards and private rooms will accommodate 77 patients in all. The most interesting room of all is the "operating theater." It is as light as a photograph gallery and close to the elevator, which is large enough to bring up a bed. The bed, with its patient, is trundled into a little room, where anæsthetics are administered before going to the theater, and the subject need never know that an audience is present at the operation.



THE NEW CANCER HOSPITAL, NEW YORK.

A SMALL SCHOOL HOUSE.

There is a prevalent idea in building school houses that a cheap building is necessarily inconvenient, and for which reason little thought is given to make it different. This is all wrong. A great deal that is convenient and nearly everything that is beautiful in architecture is more a matter of wit than money. We have it in mind to present a number of plans of small buildings, knowing as we do that there is some use for them, and because they are small will be no reason why they will not be thoughtfully considered. Mr. George H. Woodford was the architect. The elevation of this house is pleasing, and does not necessarily cost any more money than if it were ugly. However, it sometimes happens that anything out of the usual line in the matter of exterior decoration costs more money than if it were of the same general character which the builders are used to handling. However, as said before, a plan is not particularly valuable because of the exact idea which it presents, so much as on account of the general principles which may be deduced from its study. It frequently happens that a plan does one as much good by showing them what they do not want as by showing them what they do want. A good basis for departure is frequently a good thing. How much



A SMALL SCHOOL HOUSE.

will this cost? might be asked. That is largely a matter of geography. An estimate which would be nearly applicable might be too high for one section and too low for another. $1,800 will probably cover the cost in Indiana.—*Trustees' Trade Journal.*

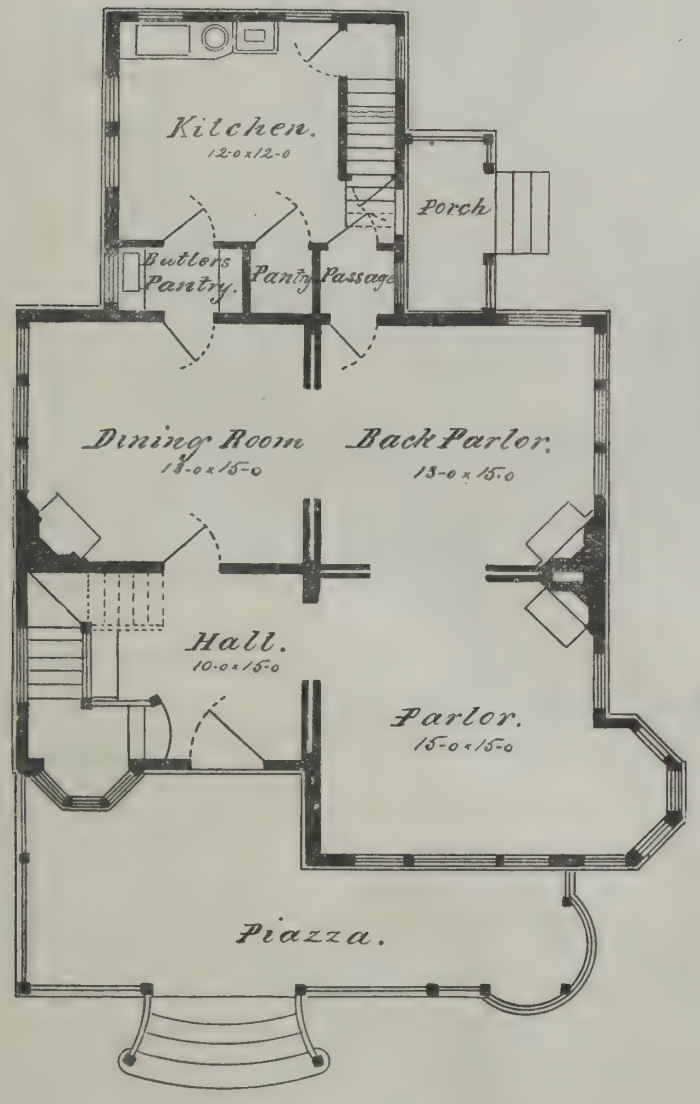
We have received Willer's catalogue of patent inside sliding blinds. It includes very full descriptions, with illustrations, of the sliding blinds and fittings, guideways, etc., for the same, which are one of the specialties of this house. Its fullness of detail and illustration will make it of value to all architects and builders, as well as to those meditating the introduction of improved window fittings in their own house. A great variety of other matter, as rolling blinds, outside blinds, designs for window frames and panelings, are also included. The catalogue is published by William Willer, Fourth and Cedar Streets, Milwaukee, Wis.

A CORNER HOUSE.

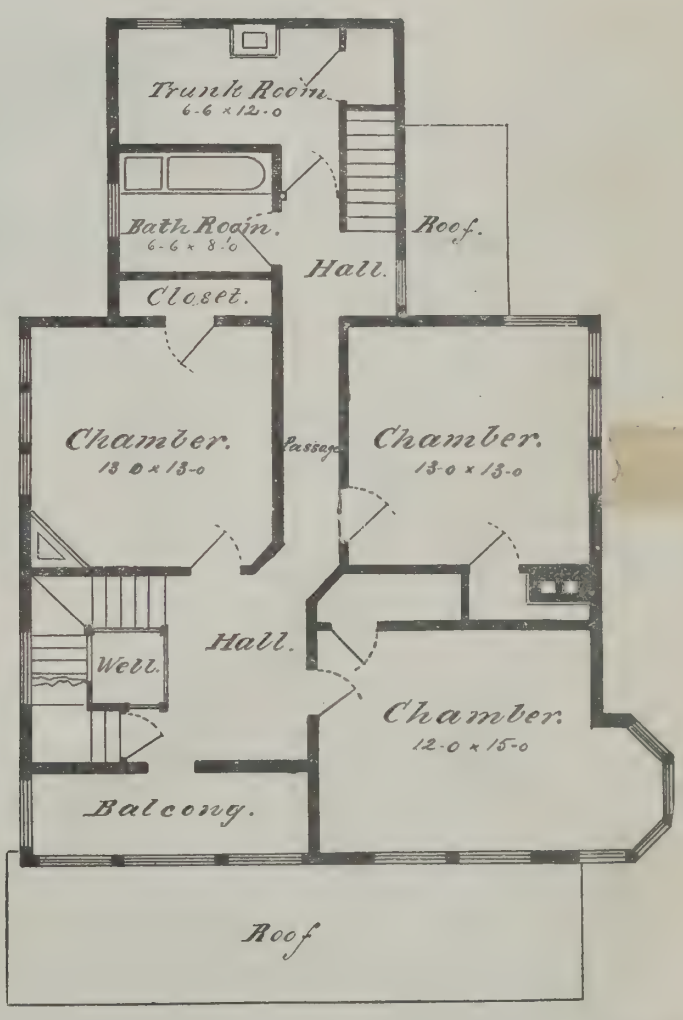
We give illustrations, consisting of plans and perspective, for a corner house, designed by Mr. C. T. Beardsley, architect, of Bridgeport, Conn. The house is intended to cost complete about $5,500. Covered on first story with clapboards, second story and roof shingles. The balcony and front entrance form a principal and pleasing feature. The painting is intended to be in strong colors. Interior walls to be hard finished. Woodwork of whitewood, filled, stained, and polished. Moulded trim. Chimneys double, as a precaution against fire Stairs finished in ash. Plumbing the very best. Heated by steam or hot air furnaces.

Classification of Styles.

The only sound classification of styles of architecture is that which arranges them according to their leading principles of construction. Of such principles, as far as we know at present, there are only three; more accurately speaking there are only two, one of which again falls into two great subdivisions. The two great systems of construction are the entablature and the arch, and the arch again may be either round or pointed. We thus get three distinct forms of construction—the entablature, the round arch, and the pointed arch. And each of these principles of construction has been, in its own time and place, the animating principle of a style of architecture. That is to say, there have been times and places in which each of the three has not only been the prevalent form of construction, but has been accompanied by an harmonious and consistent system of decoration. Each of the three constructive principles may be looked on as the expression of an æsthetical principle. In the case of two out of the three this is generally acknowledged. It is universally felt that the architecture of the entablature is the expression of horizontal extension, that the architecture of the pointed arch is the expression of vertical extension. It is generally acknowledged that the perfection of the horizontal idea is to be



First Floor.



Second Floor.

A CORNER HOUSE.

found in the highest form of the architecture of the entablature ; that is, in the architecture of old Greece. It is generally acknowledged that the perfection of the vertical idea is to be found in the highest form of the architecture of the pointed arch ; that is, in the Gothic architecture of mediæval Europe. It is not so generally acknowledged that the intermediate form of construction, the round arch, has also its leading æsthetical idea. It is not so generally acknowledged that there have been times and places in which the round arch also has produced a style, not perhaps approaching so nearly to ideal perfection as either of the other styles, but still coming near enough to it to be set alongside the other two, as an independent and equal form of art. Yet, if we admit the entablature, the round arch, and the pointed arch to be the three chief, and seemingly the three only possible, forms of architectural construction, it seems necessarily to follow that the round arch construction must have its leading æsthetical idea, no less than the other two, and that it must be capable, no less than the other two, of an ideal perfection. Whether it has ever actually reached its perfection or not, whether it has ever come so near to it as the other two have, is a question which is not now to the point. It will not do to say that there is a perfection of the arched style, but that its perfection must be looked for in the architecture of the pointed arch, and that the architecture of the round arch is an imperfect form. The answer is plain. The round arch is constructively as good a form of construction as either the entablature or the pointed arch. As a mode of building, it stands on a perfect level with them. Now, if we admit that all good and honest architecture consists in finding appropriate forms of decoration for good and honest forms of construction, it would seem to follow that every good and honest form of construction must be capable of finding some appropriate form of decoration, and of thereby reaching an ideal perfection. It seems, then, to follow that the architecture of the round arch has a right to be looked on as an independent form of art on a perfect level with the architecture of the entablature and the architecture of the pointed arch. Of course it does not follow that it has ever been actually carried so near to ideal perfection as either of the other styles. It is enough if we allow that it has, like them, its leading idea, and that it is capable of an ideal perfection, whether it has ever actually reached it or not.—*E. A. Freeman.*

RESIDENCES AT SPRINGFIELD, MASS.

Recent Discoveries at Pompeii.

Some interesting discoveries have recently been made in the excavations at Pompeii. Many silver vessels and three books were found in the Regio VIII., isola 2a, casa 23, under conditions which lead to the conclusion that the owner of those valuables, a lady named Dicidia Margaris, had packed them at the moment of the catastrophe in a cloth, in order to save something more than mere naked life, but that she perished in the attempt. Her name we learn from the books, important documents, and title deeds which she would not leave behind. These are the usual wood tablets, eight inches by five inches, coated with wax, and several of them are fastened together in book form. For the first few days after their discovery they were perfectly legible, except in a few places where the damp had destroyed the wood. After that time, probably because the wood began to dry, the layers of wax peeled partly off, splitting up into small portions. The contracts are all between the owner mentioned and a Poppæa Note, a liberated slave of Priscus, and from the names of the consuls referred to in two of them the year (61 A.D.) may be fixed. In one of them Dicidia buys of Poppæa two young slaves, Simplicius and Petrinus. Another also has reference to a sale of slaves. The third contract mentions a sum of 1,4·0 sesterces, which Poppæa Note undertakes to pay to Dicidia Margaris in case the slaves should not turn out profitable. The silver plate of Dicidia formed a set for four persons, but as it was gathered up in haste, it is incomplete. It comprises four goblets with four trays, four cups with handles, four smaller cups, four others, four cups with feet, a cup without a handle, a filter, a small bottle with perforated bottom, a spoon, and a small scoop. The total weight of the articles is 3,943·70 grammes (not quite 127 oz. troy). There was also found a silver statuette of Jupiter on a bronze pedestal, as well as a large bronze dish with raised edge and inlaid with a finely chiseled silver plate, and, finally, three pairs of ear pendants. The excavations at Pompeii have yielded abundance recently also in other ways. Numerous surgical instruments (mostly of bronze) have been found, which appear to have been kept in a wooden box ; also a small pair of apothecary's scales and a set of weights, equivalent to 14, 17·5, 21, 24·9, and 35·8 grammes respectively. Among various domestic utensils found may be mentioned as noteworthy a beautiful stew pan of bronze, the silver inlay of which represents a head in raised work, and a bronze lamp, still containing the wick ; finally, various glass vessels, terra cottas, gold rings, and ear pendants. Among the finds of coin are a sesterce of Vespasian with Fortuna on the reverse and the inscription "Fortunae reduci," and a dupendium of Nero with the temple of Janus and the inscription "Pace per ubiq. parta Janum clusit."

RESIDENCES AT SPRINGFIELD, MASS.

In our last number we gave a few illustrations of some of the residences at Springfield, Mass. We present herewith two additional views, prepared from photographs. No. 1 is the residence of Mr. Kellogg, on Maple Street, and No. 2 that of Mr. Appleton, on Crescent Hill. Both dwellings have a substantial and pleasing aspect, although entirely different in the style of architecture.

Pressure at which Lead Pipes Burst.

Bruce and Thomson, of Glasgow, have been making some experiments on the pressure necessary to be acquired before lead pipes burst.

Their results show dissimilar conditions for different sized pipes. The pipes used by the Glasgow water works are not selected by their strength or quality, but according to their weight per lineal yard. One-half inch pipes run 7 lb. per yard and 1½ inch pipes 24 lb. per yard.

In a ½ inch pipe the bursting pressure per square inch was found to be 1,820 lb.

In a 1½ inch pipe the bursting pressure was 812 lb. per square inch

Mr. Jardane, another experimenter, found a 1½ inch pipe, ⅛-inch thick, to stand a head of 1,000 feet without alteration. With 1,200 feet head it began to swell ; with 1,400 feet head it enlarged to 1¾ inches and burst. The bursting pressure was 606 lb., and the tensile strength was 2,611 lb.

A 2-inch pipe stood 800 feet head without alteration, but at 1,000 feet head it burst, the bursting pressure being 433 lb., and the tensile strength 2,412 lb.

The best authorities give the safe working pressure, without shocks, at one-tenth the bursting pressure, and in a system with shocks, like heavy water hammer, at one-twentieth of that strain.

To cut glass, place it in water on a level with the surface, then clip it with a pair of scissors as if it were a piece of paper. To avoid risk, it is better to perform the cutting by taking off small pieces at the corners and along the edges, and to reduce the shape gradually to that required. The softer glasses cut the best, and the scissors need not be very sharp.

INTERIOR OF A RESIDENCE AT CHATTANOOGA, TENN.

In our number for January last we gave the elevation and plans for the handsome residence at Chattanooga of Mr. D. J. Chandler. We have now been favored with a perspective sketch of the main stairway and part of the hall of the same dwelling, which we here give, and for which we are indebted to the architect, Mr. W. H. Floyd, of Chattanooga. It is a most excellent and pleasing design.

New Materials and Inventions.

BY J. SLATER, M.A.

At the recent conference of architects, London, a paper on this subject was read by Mr. Slater, in which he described certain modern inventions that interested him. He began with referring to experiments which demonstrated that unless traps are ventilated they are liable to be unsealed. It is absolutely necessary, if the trap is to be a safe one, that all the trap branches into the main pipe should have an ample ventilating pipe carried up from them, and branched into the main pipe above the point where the highest trap branch enters it.

In connection with this subject it was mentioned that experience seems to point to the desirability of decreasing rather than enlarging the size of pipes; 4 in. glazed earthenware pipes for house drains, and 3½ in. lead pipes for soil pipes, if properly connected and laid, will suffice for all purposes, and will keep much cleaner than those of larger bore, always supposing they are properly flushed out. The following inventions were noticed:

1. Messrs. Doulton's new form of nosing for stone or concrete steps. This is called the silicon tread, and is a kind of terra cotta, *i. e.*, clay burned as hard as it is possible to bake it. These treads were used for three years at the recent exhibitions at South Kensington, and must have had several millions of persons passing over them.

2. Mr. Wright's "coke breeze fixing blocks." These are made of the same size as an ordinary brick, and can be built in the walls wherever required, and their constitution is such that they will hold nails as well as wood. They can be used for fixing skirtings, dados, and linings of all kinds on the interiors of brick walls, and for external use if a portion of a wall is to be hung with tiles.

3. The American "Wight" fireproofing system, consisting of iron joists, concrete, and hollow fireclay tiles of different depths. The hollow tiles are temporarily supported by centering, and are set in cement, the middle tile acting as a keystone. The bottom edges of the tiles are grooved, in order to give a good key for the plaster of the ceiling, and on the top of the flat arch thus formed concrete may be laid of any thickness that seems desirable, thus entirely incasing the iron girder. The weight of the deeper arch is about thirty-five pounds per foot super.

4. An American method of making wooden floors practically fireproof on the under side. This is done by flat interlocking fireclay tiles carried by iron clips screwed to the joists, the under side of these tiles being grooved to form a key to the plaster. A space of two inches is thus left between the plaster and the wooden joists, and as the tiles themselves will stand almost any heat that can be brought to bear on them, the joists are absolutely protected. On the upper side fine concrete or pugging might be used. This system of fireclay ceilings can be affixed to existing floors by simply hacking off the lath and plaster.

5. An American way of fireproofing wrought iron columns by incasing them with fireclay blocks. The fireclay blocks are grooved and are secured by iron plates with claws, which fit on the rivet heads. In circular cast iron columns a metal band is brought round the column, hooked together, and dropped into the groove of the blocks. In either case a heavy bed of mortar is next applied, and then another course of blocks is bedded, or, as the Americans say, "crowded down," over the band or plate. This process is continued until the column is entirely incased, then it is plastered with Keene's or Parian cement, making a good surface for decoration.

6. The Doulton-Peto fireproof blocks. These are extraordinarily like the first kind of American arch blocks. Mr. Slater believed the idea was obtained from the American system, and had no doubt that Mr. Doulton would carry this system further in the way of casing columns, etc.

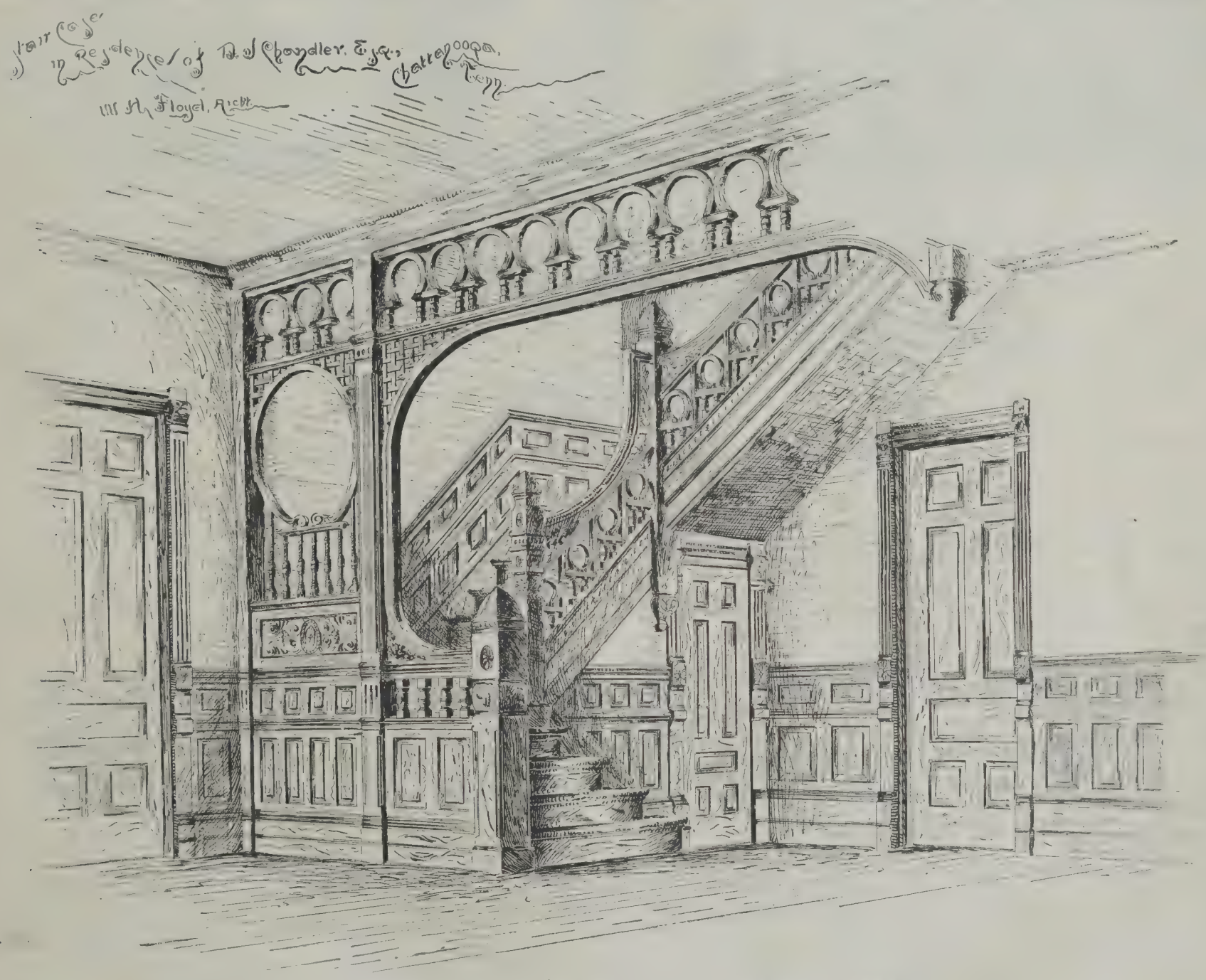
7. Lindsay's steel decking, which consists of a series of steel troughs riveted together and supported either on walls or on girders, and filled in with concrete. For a space of thirty feet the depth of the decking need only be five inches to support a load of one and a half hundredweight per foot super. Messrs. Lindsay roll many sections of steel which can very easily be formed into columns by riveting.

7A. A metallic cement which allows decayed stone to be restored in an effective and economical way.

8. A substitute for wood lathing, either for partitions or ceilings. This consists of galvanized iron netting, which is fixed by staples to hoop iron slips, which are themselves secured edgewise to the studs or joists. The wire netting is then covered with plaster in the ordinary way. The wooden framework of the partition may be replaced by a construction of angle iron, which takes up only half the space of an ordinary quarter or brick-nog partition, and this saving of space may sometimes be of considerable importance.

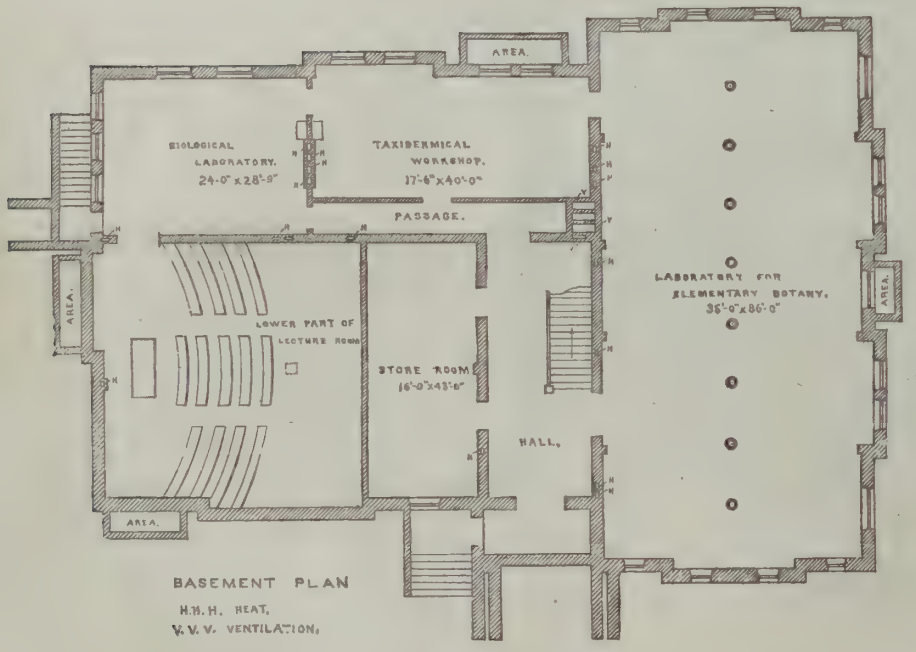
French Plaster.

Gypseous stones, from their soft and friable nature, and the facility with which they decompose in the atmosphere, are not allowed to be used as building materials in Paris. Sometimes inclosure walls are built of them, employed as *moellon*. The principal use is in the fabrication of plaster. The chemical nature of these stones as found at Montmartre, Belleville, Charonne, Menilmontant, Le Calvaire, Triel, and Meulan, is, according to Fourcroy, 32 parts of oxide of calcium, 46 parts of sulphuric acid, and 22 parts of water. They differ from the gypsums of other countries in the large quantities of lime they contain, which gives them greater powers of resistance to the action of the moisture of the atmosphere. The operation of burning consists simply in driving off the water of crystallization. In this state the plaster has a remarkable avidity for water, and immediately that any is presented it absorbs it, and crystallizes around the bodies in its immediate vicinity. The singular fact of the swelling of the plaster during this process is one that requires great attention in the employ of the material. Another fact worthy of notice is cited by Rondelet, namely, that two bricks set together with plaster adhere with one-third more energy than bricks set with lime during the first month, but that afterward their adhesion diminishes, whereas that of the bricks and mortar increases almost indefinitely.—*G. R. Burnell.*



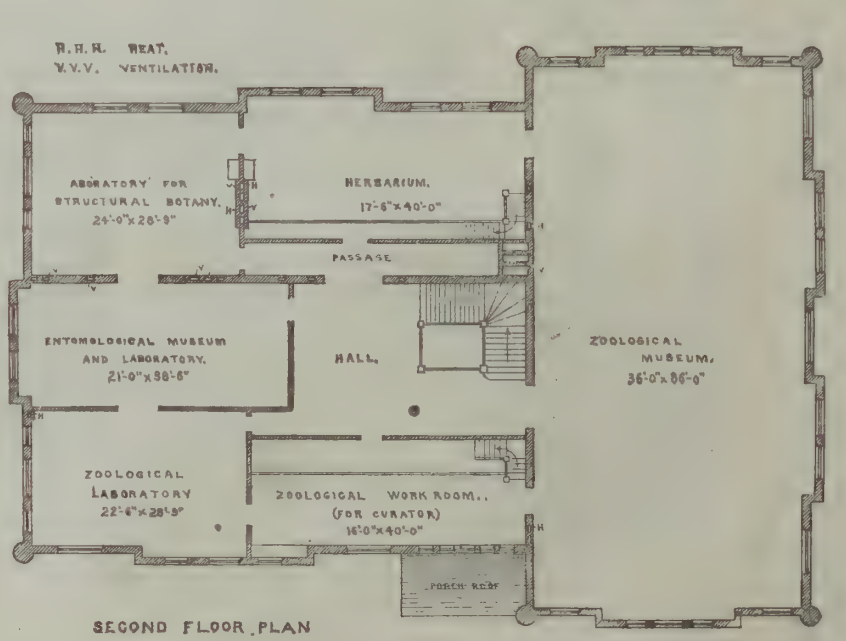
INTERIOR OF A RESIDENCE AT CHATTANOOGA, TENN.

DURING some recent building operations on the Thames, an old pile of the first London bridge, built in the days of William the Conqueror, was dug up. It was twenty feet below the surface. It was a stout piece of oak nine inches across, and had withstood the mud and water of the Thames for eight hundred years.

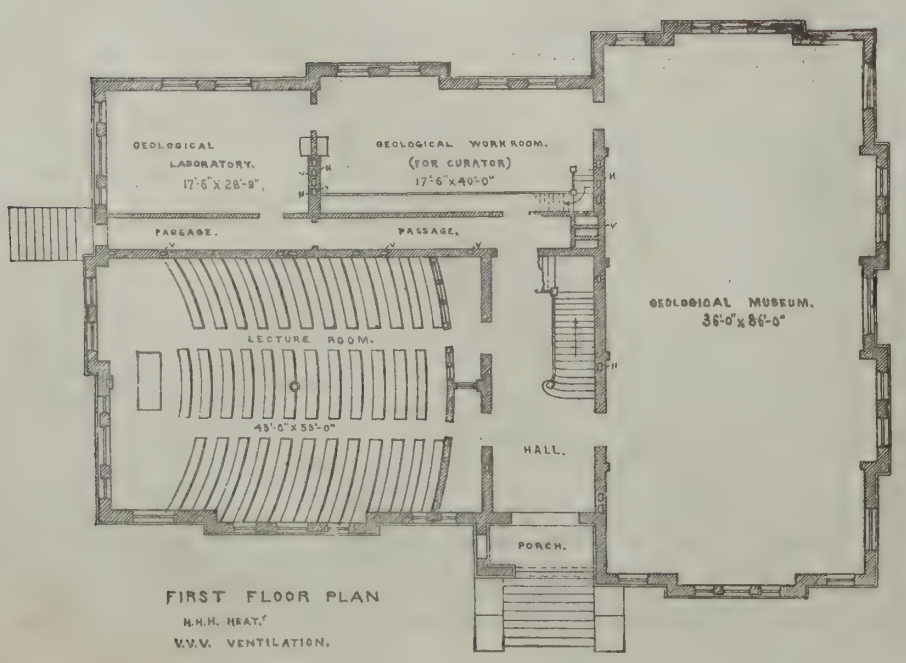


BASEMENT PLAN

H.H.H. HEAT,
V.V.V. VENTILATION.

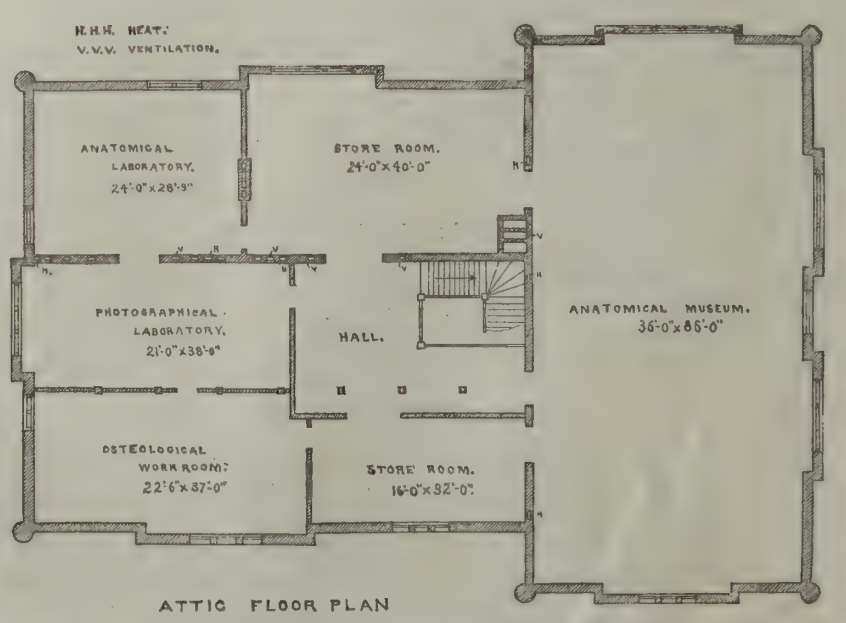


SECOND FLOOR PLAN



FIRST FLOOR PLAN

H.H.H. HEAT.
V.V.V. VENTILATION.



ATTIC FLOOR PLAN

SNOW HALL OF NATURAL HISTORY—MR. J. G. HASKELL, TOPEKA, KAN., ARCHITECT.—[For description see page 42.]

AN APARTMENT HOUSE.

We present on our first page the elevation of a splendid apartment house, designed by Mr. George H. Griebel, architect, of this city, No. 67 West 23d Street. A plan of the first story is given on this page. The design presents many advantageous features and exhibits a vast amount of careful study.

The apartments in these plans were intended to be sold, not rented, and are each inclosed on that account by brick walls. They are fire proof throughout in construction.

The main entrance to the building leads to a court, where the main entrances to apartments are placed. These are accessible on the first story, which is eight feet high. The servants' and business stairs and elevators are accessible from basement and sub-basement.

Each story contains six large apartments, with the exception of first and second stories (containing each four). The west wing of these two stories was originally intended to contain an art gallery and artists' exchange, with exhibition rooms, offices, etc. Besides these, were intended a sculptors' exchange and glyptotheca in the basement, and some large studios in the ninth story, where the restaurant and dining rooms, cafe, billiard rooms, etc., are placed, all accessible by elevators, to be only for the use of the house.

The kitchen in roof of west pavilion. Part of the flat roof was proposed to be used in connection with the cafe. There are fifty apartments in all, each thoroughly private and provided with every modern improvement.

APARTMENT HOUSE—FIRST STORY PLAN—GEO. H. GRIEBEL, ARCH., NEW YORK.

THE OPERA COMIQUE, PARIS—INVESTIGATION OF THE CAUSES OF THE FIRE.

It will be remembered that last year the building of the Opera Comique, in Paris, was totally destroyed by fire, with loss of many lives. This dreadful calamity was made the occasion of a rigid inquiry as to its causes, by the French government, with the intention of meting out exemplary punishments upon those who might be found guilty of neglect. The official inquiry was continued for a long time, and was only lately brought to a close. Over two hundred witnesses were examined.

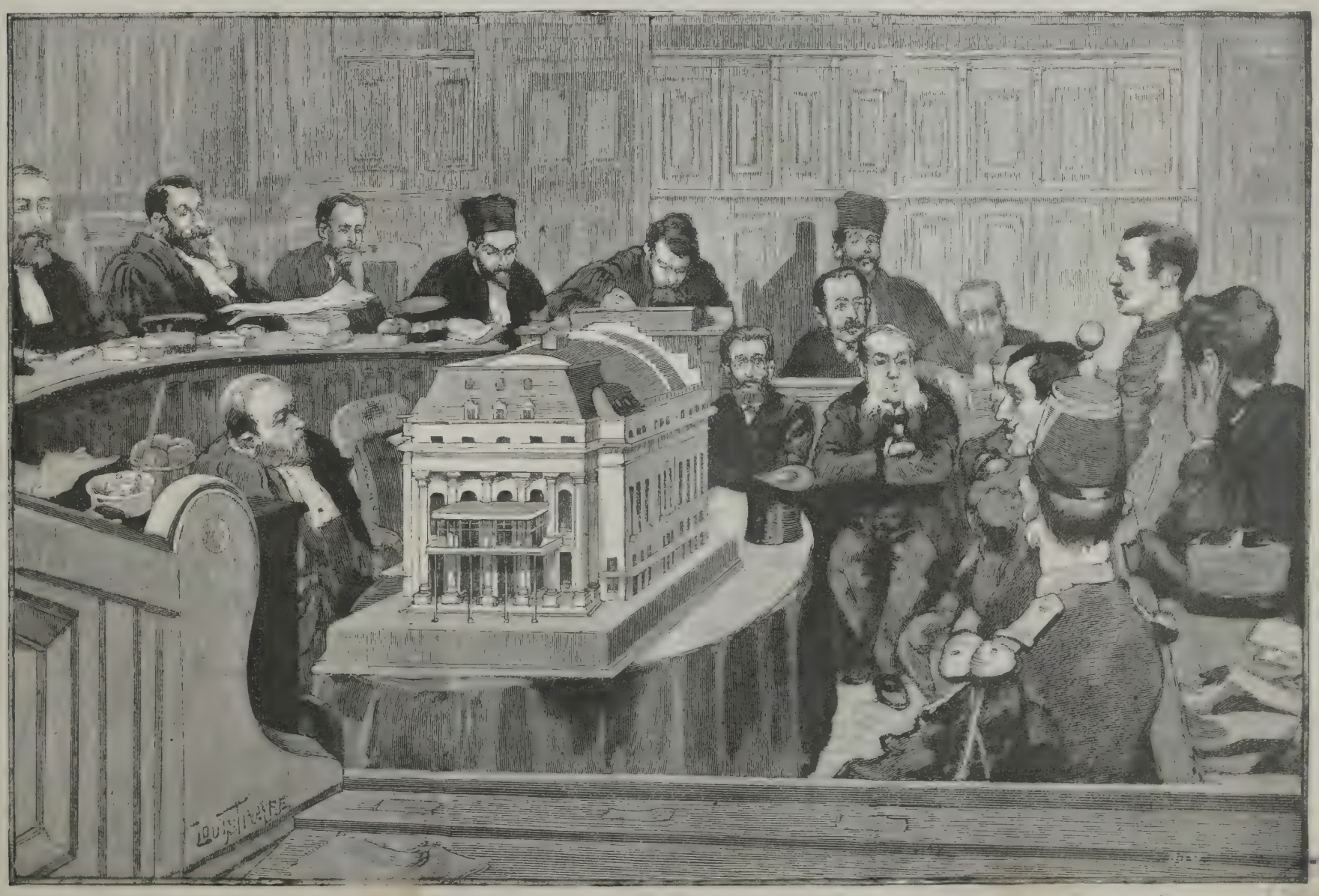
We give from *Le Monde Illustre* an illustration of a scene in the court of inquiry, also the following particulars:

After the first examination of the accused, as after the first testimony of the witnesses, it appeared, contrary to what had at first been asserted, that the theater was well provided with all the accessories required by law for the extinction of fires. There was plenty of water in the reservoirs and the firemen were at their posts, but the rapidity with which the flames spread was so great that they lost their presence of mind and did not execute the orders quickly enough. So much for this terrible disaster, which caused so many tears to flow and compromised so many interests.

The interesting debates have been eagerly followed in the daily papers. We have simply taken up the picturesque side of the scene in court, where a cardboard reproduction of the Opera Comique occupies the central point of attraction. Portions of the building may be removed, and the defendants are enabled thereby to illustrate certain parts of their testimony.

New Method of Waterproofing Brick Walls.

A method of making brick walls impervious to moisture, according to the Vienna *Gewerbe Zeitung*, is known as the Sylvester process. It includes two successive treatments, the first with soap and water, the other with alum and water. The solutions are three parts by weight of soap to one of water, and one of alum to twenty of water. The bricks must be perfectly dry and clean, and the temperature of the air should not exceed 50° F. The soap solution is first laid on while boiling hot, with a flat brush. After twenty-four hours' standing, this coating will be hard and dry, and then the alum is applied at a temperature between 60° and 70° F. After twenty-four hours the whole process is repeated, and again is repeated until the wall becomes impermeable. The number of times the treatment has to be applied depends on the pressure of water to which the wall is to be subjected.



OFFICIAL INQUIRY CONCERNING THE OPERA COMIQUE, PARIS.

THE ANNISTON INN.

The Anniston Inn is one of the great hotels of the South. The founders of Anniston, in locating an entirely new town amid the wealth of the mineral region, laid out the place on large lines, presupposing growth to the importance of a great mining and manufacturing center. At the same time, at a great expenditure, they insured those advantages of railroad transportation which, while they assist the growth, are of vital consequence to the position of an important town. The Inn was planned with the same regard to the future, and in architecture and appointments is on a par with the best examples of its kind in the country. Occupying the crown of a gentle eminence and surrounded by beautifully kept lawns, it is a commanding object from all sides.

Its outline is exceedingly picturesque, being broken by gables, dormer windows, and massive chimneys that remind one of Dickens' charming description of the old Maypole Inn. The wide verandas, extending entirely around the first three floors, indicate the mildness of climate, which permits at almost all seasons out door enjoyment in easy chairs. The interior is in keeping with the outside. The fittings are of solid wood, brightly polished, relieved by unique tiles and rich tapestry. The stained glass of the windows and the artistic draperies are harmonious parts in producing the general effect, which recalls the solid magnificence of an old time palace. The whole of the apartments, according to their uses, exhibit the same cultured regard for artistic propriety, and unstinted expenditure on all that can conduce to massive elegance and comfort. The house is lighted throughout with incandescent electric lights and with gas, and is admirably ventilated.

In all that relates to provision for the comfort of the guest, the desires of the most fastidious have been anticipated. To avoid a prolongation of details, it may be said that the Anniston Inn is one of the best and completest in the whole South, which, in this era of great hotels, is sufficient commendation. Mr. Hardell, its manager, has been a very successful hotel keeper at the North, and his conduct of the house is every way worthy of its grand and sumptuous character.—*The South.*

DECATUR, ALA.

Whoever wishes to gain a positive idea of the immense industrial progress which is now going on in the southern portion of our country should study the pages of that excellent and enterprising periodical *The South.* In a recent number we find an interesting article descriptive of the changes that have taken place at Decatur, Ala., with illustrations of some of its elegant new buildings, and particulars of its wonderful mineral and manufacturing resources. We are indebted to *The South* for the engravings herewith presented, and also for the following notes relating to Decatur.

Decatur, as it stands to day, a nascent industrial city, with large manufacturing establishments rising on all sides to the sound of hammer and trowel, is truly a phenomenon; but to fully realize its exceptional character—which makes it a phenomenon among wonders—a little consideration is necessary. As an example of rapid growth, Decatur has perhaps no parallel in the South. Yet it is but one instance of many of an unexampled activity in this direction. The circumstance that gives to it its phenomenal character, in comparison to other examples, is the astonishing magnitude and number of the enterprises that have clustered around the spot, at a signal, one may say, from the promoters of the great plan of making Decatur one of the most important manufacturing cities in the South The year 1887 dawned on a place that, besides unbounded natural advantages in productive fields, timber lands, and underlying minerals, with transportation provided by two great railway systems and the Tennessee River, had little to distinguish it. The railroad companies, the Louisville and Nashville and the Memphis and Charleston, together employed in the handling of cars about 100 men. There were extensive saw mills, a stove and barrel factory, and a machine shop. Otherwise, Decatur was commended mainly by its possibilities. On the 11th of January, 1887, the Decatur Land Improvement and Furnace Company was organized, consisting of Major E. C. Gordon, president; Judge H. G. Bond, vice-president and general manager; and Dr. W. E. Forest, secretary. Mr. E. B. Joseph, Major J. R. Stevens, Mr. J. F. Flourney, Mr. J. C. Wooten, Mr. C. P. Branch, Col. J. D. Roquemore, and Capt. H. A. Haralson made up a very strong and effective board of directors, each of these gentlemen being a prominent representative of some important Southern corporation.

The company's preliminary step was the purchase of over 5,000 acres of land in and adjacent to Decatur, and immediately thereafter work was started in laying out a model city and inviting manufacturers to come in as pioneers and take advantage of a growth of which the favorableness of the site and the strength of the company were an almost positive guarantee. The response to the invitation, embodied in visible evidences on all sides, is a phenomenon which grows on the beholder; for besides the enterprise and financial strength implied by the mammoth factories and shops in course of construction, there is the fact that these incipient undertakings have already the guarantee of success, and if completed would be taxed to their utmost capacity. As a case in point, the Decatur Iron Bridge and Construction Company, before its works were finished, secured the heaviest contract for an iron bridge ever given south of the Ohio, and many similar instances might be quoted. Side by side with the work of establishing manufactures goes on that of carrying out the plan for a great city, and erecting palatial buildings for residence and public accommodation. The company in its work of creating a new Decatur has shown a foresight that seems almost a gift of prophecy. It assumed that Decatur was to be what it is fast becoming, and it set about its preparations as if the whole future lay mapped with the distinctness of a tangible present. The following brief and by no means exhaustive particulars will further indicate the phenomenal character of the movement.

NATURAL ADVANTAGES.

In no part of the South has Nature's magnificent liberality been shown more strikingly than in the country tributary to Decatur. The town is situated on a bank of the Tennessee River, on both sides of which for many miles extends a country second to none in its promise to the agriculturist. Here are some of the finest farming lands in the world, and here are produced luxuriant crops of the cereals, with cotton, tobacco, vegetables, and fruits. The grasses flourish, and the country is well adapted to stock raising. The climate, striking a mean between excess of heat and cold, is every way conducive to health and longevity.

Of timber, the country adjacent and tributary to Decatur contains, in the utmost variety a supply that will hold out against all possible demands for many years.

But we must turn to another class of natural gifts, whose presence and utilization mainly account for the movement begun at Decatur. The brown and red hematite ores and the vast beds of coal underlying the fertile surface in rich masses all around are an incitement to capital and industry to build up a great manufacturing center amid possibilities that are nowhere surpassed. The counties immediately adjacent are literally floored with iron and coal, while the network of railroads finished and projected will make this mineral wealth in every direction available to Decatur as a nucleus. In parts of Alabama iron can be made and sent to Northern markets to undersell the product of Pennsylvania and Missouri, and Decatur has peculiar advantages for the manufacture of cheap iron. The red fossiliferous ore, assaying 47 per cent. metallic iron, may be laid down in the city for $1.25 per ton, and the brown hematite, assaying 55 per cent., at $1.50. Fuel and limestone are within easy reach, and charcoal will be manufactured on the spot in abundance. The latter material will be had under the most favorable conditions, as, instead of being made for the purpose, it will be a by-product of other manufactures. Coal can be delivered at Decatur for from $1 to $1.50 per ton, and furnishes an excellent quality of coke for iron ore smelting and foundry uses. Of other mineral resources may be mentioned excellent limestone, asphalt, building stone, marble and granite, sand for the manufacture of glass, manganese and potter's clay. Natural gas has been struck and is expected to be forthcoming in paying quantities.

The Tennessee River at Decatur is a wide, deep, and beautiful stream, with high banks and fertile lands, upon which corn and cotton flourish. This fine river is navigable for steamers for many miles, while for 400 miles above Decatur it floats the timber which abounds along its course. Its numerous tributaries also perform the same service, thus rendering the primeval growths of oak, pine, poplar, ash, hickory, red gum, beech, cherry, and black walnut available. Thus this vast wealth can be delivered to the manufacturers of Decatur at a nominal cost. This fact has led to the establishment of saw mills, chemical works, oak extract works and other industries upon its banks at this point. It is a specially favorable point for the manufacture of charcoal iron. Among advantages of man's provision, in the relations of a place to the outside world, railroads stand first. Decatur's water transportation facilities are supplemented by two completed trunk railroad lines, the Louisville and Nashville and the East Tennessee, Virginia, and Georgia. The Rome and Decatur road is being pushed to completion, and a charter has been obtained for the Southern Kentucky, which is to connect Decatur with the eastern and northern seaboard.

The accompanying engravings represent prominent buildings. Most conspicuous among the examples is the great Casa Grande Hotel, the foundations for which are being prepared. This hotel, to cost $400,000, and to be opened some time in the coming year, will rank easily among the grandest in the country. It is to have

THE TAVERN, DECATUR, ALA.

a frontage of 680 feet, and will be 325 feet in depth. Its designer is Mr. L B. Wheeler.

The Tavern, already opened, is a graceful modernization of the quaint "half-timber" style of our forefathers. It is lighted by the incandescent system, has seventy rooms, and is conducted on a liberal scale. The Casino cannot fail to be a striking object, and the almost wanton luxury of its design bespeaks the softness of the climate. Surrounded by lawns and bowers, its galleries hung with rich foliage and blossoms, it is a suggestion of fairyland set amid the coal, iron, timber, cotton, and wealth producing industry of the new South. An opera house of fine architecture, with a seating capacity of 1,200, is to be erected by Mr. F. P. O'Brien.

All of the buildings, designed or in progress, are characterized by solidity and taste. Bond's Block, which will contain the business offices of Judge Bond, is creditable to the finest street of any city, speaks for itself. The Casa Grande stable will be a fine building, costing almost a fortune. The new private residences all show a liberal expenditure of means and taste, and it is intended that every adjunct of the city in its degree shall conform to a high standard.

THE CASINO, DECATUR, ALA.

CASA GRANDE, DECATUR, ALA.

Building Prospects.

There are two features among the many upon the surface of trade which are deserving of special consideration with those who are endeavoring to formulate opinions as to this year's probabilities. One is the extraordinary growth of building and loan associations and the other is the multiplication of projects for building and manufacturing purposes. If there were any apprehensions of a permanent reaction in industrial activity, they are rapidly disappearing. The stock markets exhibit an upward, expanding tendency in values. The bulls are having a holiday, and a spirit verging on to stock speculation is beginning to manifest itself in not only Eastern, but in some smaller Western commercial and financial centers. It is roughly estimated that $750,000,000 are finding employment through the channel of building and loan associations, but whether this figure is near or far off the mark, the facts which are known justify the statement that this system of co-operative banking and loaning and buying is expanding with great rapidity, especially throughout States west of the Allegheny Mountains.

It was thoroughly tested in Eastern cities, particularly in Philadelphia, and the importance of it will soon become recognized throughout the Western cities and towns. Associations have been formed very rapidly this year, and in nearly every Western town steps have been taken to organize the producers into house building societies. These associations are valuable in their educational features, for they lead to the discussion of questions, to habits of thrift and economy which would never be otherwise developed. It is shown by credible statistics that for the past ten days over one hundred million dollars' worth of projects have been heard of, and the statement is made upon the same authority that the spirit of investment is likely to manifest itself more strongly later in the season. The money market is easy and rates of interest are low. Financial and commercial operations in Western cities, such as Chicago, St. Louis, St. Paul. Kansas City, and some others, all show an enormous distribution is going on, and that enterprise is still seizing opportunities of every variety. There is nothing as yet in the horizon to justify much of the apprehension that is expressed in some trade journals.

In Philadelphia, during the past ten months, 6,079 two and three story houses have been erected, and in all 6,640 buildings, including warehouses, factories, churches, schools, etc.; the total estimated value of which is, in round numbers, $24,000,000. The builders and architects of that city, in interviews recently, state that the indications for the coming season are fully as encouraging as a year ago. A great deal of land both in and near the city has been purchased for next year's building requirements. Reliable building authorities in New York say that large purchases of land have been made in suburban localities for building purposes in the upper end of the island, as well as on Long Island. Real estate in the more desirable localities has been steadily advancing in value, although not to the point of prohibiting enterprise. Statements from Chicago within a few days show that there is much to hope for in not only that city, but throughout the Northwest next year.

The building trades throughout the country are pretty compactly organized, and have held their own in recent conflicts. It is earnestly desired by builders in all sections of the country to adjust all differences during the winter, in order that calculations and contracts can be safely entered upon for material for work during the next year. The workmen themselves are coming to recognize that a conservative course on their part is more desirable than an extreme one, and it is quite probable that measures will be mutually agreed upon which will obviate a suspension of work after the opening of the busy season. While it is largely a matter of opinion as to the extent of building enterprise next year, the very best authorities among architects and builders lean strongly to the belief that there will be very little, if any, decline in building activity. Throughout the West the municipal authorities are arousing to the importance of extending school facilities, and a great deal of work of this character will be entered upon. In the great multitude of Western and, in fact, Southern towns, it is evident that there will be a vast amount of shop, factory, and house work undertaken. There is an abundance of capital available, and at low rates of interest. Local authorities have been investigating the conditions surrounding the outflow of Eastern financial centers to Western farms, and the investigations show a very encouraging condition of things.

The demand for shop room, house room, and room of all kinds, as well as for more rolling stock, more steam power, and more electrical power of every variety, is strengthening the productive agencies and leading all manufacturers to feel that there is a busy time ahead of them for months to come.—*Amer. Architect.*

Importance of Carpentry.

The carpenter has more to do with the construction of a building than any other person employed by the architect. Whether a building is to be erected of brick or stone, still it is the carpenter who forms all the patterns and guides for the bricklayer or the mason to work from. Nay, even if a cottage is to be built of mud, the first step is to procure boards adapted by the carpenter for forming moulds, by which this mud is brought into the required form; or, even if the mud is heaped up with forks, as in the cob walls of Devonshire and Wiltshire, the carpenter is required to supply what are called wooden bricks, to be built into the walls for attaching, at a future period, the internal finishings.

In the interior of a house everything depends on the carpenter, and most things are, indeed, done by him. The floors and the doors and windows are almost entirely his work, and he forms mouldings for the cornices which are put up by the plasterer. If, therefore, we could improve the taste of the rising generation of carpenters, we should have no fear of operating, through them, on all the various artisans employed in the construction of houses, and, ultimately, on the general taste of the whole community.—*J. C. Loudon.*

Permeability of Building Materials.

It is well known that brick, stone, and even cement are not only porous, but allow vapors to pass through them. Some time since a French *savant*, M. Marcker, made experiments with a view of testing the permeability to gases of certain materials. He found that granite, porphyry, slate, alabaster, and limestone are practically impermeable. The question of transpiration is an important one. Houses built of impermeable walls are dry, though it is doubtful whether, under all circumstances, they are the most healthful. All will admit, however, the advantage of cutting off by a really impermeable layer the house, to avoid gaseous emanations from soil that is not of virgin quality, and the gases from drains. For such purposes we require impermeable materials Of all that we know, the best asphalts and the bituminous compound known as White's Hygienic Rock Composition appear to be the most perfect and easily applied. Concrete, however, well made, is not so completely impervious to vapor, and even cement has been found to allow vapors and gases to pass through it. With regard to walls, the cements that are used give all the required impermeability. A thick glazed paper is said to reduce the permeability of a brick wall nearly forty per cent., and two coats of oil paint considerably help toward the object. A new kind of wall decoration has lately been introduced from France, which consists of thin sheets of metal painted over by a patented process. Tinfoil in sheets is the material used, and this is gilded or painted over. The covering is waterproof, and, we should say, is an excellent substitute for paper on damp walls.—*Building News.*

A RIVERSIDE RESIDENCE, MAIDENHEAD.

This house is being erected on the Maidenhead Court estate for Mr. C. Gervaise Boxall. The site, a beautiful one, about one-third of a mile above Boulter's Lock, and easily accessible from Maidenhead or Taplow, comprises over an acre of land and faces Cleveden Woods, the garden, with lawn tennis court, running down to the tow path. Externally, the house is built of red bricks, hung tiles, and framed timbering in oak. The ground floor, raised three feet above the general ground level, has the following accommodation: Drawing room and dining room, with large inner hall between, directly facing the river, the partition between the drawing room and inner hall being a framed and paneled partition, and easily removable at will, thus enabling these two rooms to be thrown into one for dance or theatrical purposes. The ground floor also contains entrance porch and vestibule, with staircase hall, kitchens, and usual offices. The first floor contains six good bed rooms, dressing room, and bath room, with hot and cold water supply, the principal bed rooms opening by means of French casements on to a projecting balcony facing the river. From this balcony a most beautiful view is obtained up and down the river—the weir and backwater behind the island that carries the water to the mill below.—*Building News.*

THE BIRTHPLACE OF JAMES WATT.

The inventor of the steam engine, for all practical purposes, was certainly one of the greatest benefactors of mankind. James Watt was born at Greenock, on the Clyde, in 1736. The house in which he was born, No. 13 Dalrymple Street, in that town, has lately been pulled down by the Greenock Improvement Commissioners. We have to thank Mr. Cathcart W. Methven, engineer to the Greenock Harbor Trust, for a sketch of the street, showing the position of the house. It will be marked by a memorial tablet on the new building to be erected on this site. James Watt, in his youth, was apprenticed to a maker of mathematical instruments. He began, at the age of twenty, to make experiments with steam as a motive power. In 1770 he commenced practice as an engineer, and in 1774 entered into partnership with Mr. Matthew Boulton, of the Soho works at Birmingham, where his grand inventions were applied with speedy success and results of amaz ing magnitude. James Watt retired from business in 1800, and died in 1819. He was the inventor also of the copying press, of improvements in the process of bleaching, and of many useful appliances in the manufacturing arts.—*Illustrated London News.*

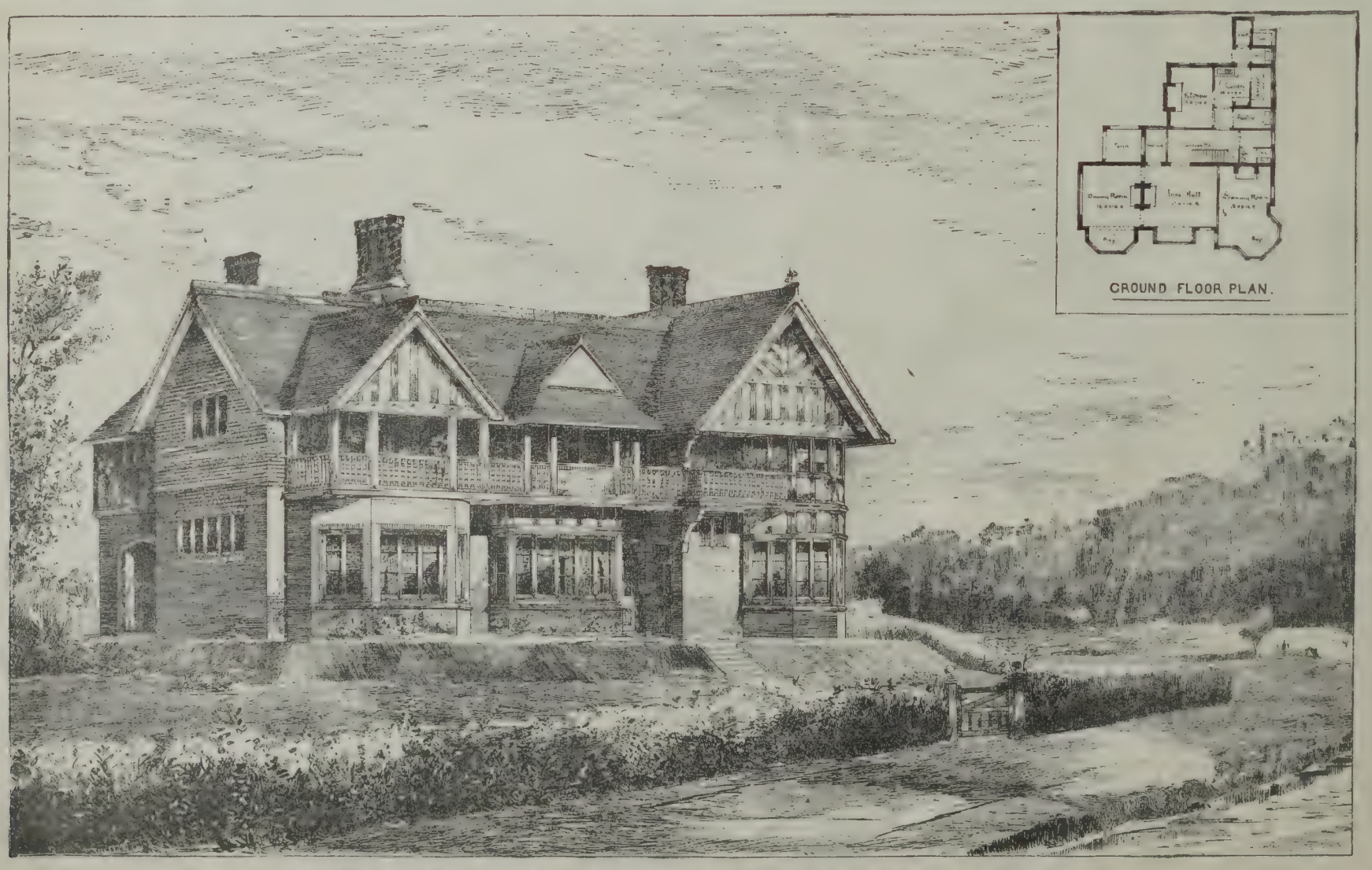
THE BIRTHPLACE OF JAMES WATT.

Compost for Cuttings.

As an illustration of the success attending the use of pounded charcoal and finely broken crocks, when mixed with the soil in which cuttings are inserted, I may mention that I have recently carried out an experiment with a quantity of rhododendron cuttings, putting about an equal portion of each into three different kinds of compost. The first was sandy peat, the proportion of sand being about the same as in that used for potting purposes; the second was peat and sand in about equal proportions; while the third was the same as the last, with the addition of a quantity of pounded charcoal and crocks sufficiently fine to go through a sieve with a quarter of an inch mesh. Now that nearly all the cuttings are struck and potted off, I have had ample opportunity to compare the relative value of the different kinds of compost. By far the best rooted cuttings were those in the soil containing charcoal and crocks, the young and delicate rootlets clasping the small nodules so tightly that the latter did not drop off when turned out of their pots and repotted. Whatever be the reason, contact with the pot either around the sides or in the shape of broken crocks at the bottom will undoubtedly hasten the formation of roots, as may be often seen in turning out a pot of cuttings, when those on the outside that are in contact with the pot will be rooted, and should one be longer than the others and rest on a broken crock, the chances are that it will be struck as well as the others, while the bulk of those in the center of the pot will not have reached that stage.

In putting in rhododendron cuttings, the best are furnished by the shoots of the current season, and when they are not more than 4 in. long the entire shoot can be taken as a cutting, being separated just at its base where it starts from the older wood. Should the shoot, however, be much longer than this it may be shortened, for in most cases the season's growth consists of a shoot with a quantity of leaves on the upper portion and a considerable amount of bare stem below. Therefore, should a long shoot be separated at its base and put in as a cutting, when struck it would be at best a leggy plant, and however it might be pinched back, it would not break from the lower portion of the stem. In fashioning off the base of a cutting, it is far better to do so by means of a sloping cut, as there is then a larger surface for the production of roots. I have frequently made use of crocks and charcoal for cuttings that were difficult to root, having among other things struck some of the Cape silver tree (Leucodendron argenteum) in this way, and it is by no means an easy subject to strike.—*T., The Garden.*

It is claimed that a wild grapevine growing near the bank of the Sawhatchee Creek, near Blakely, Ga., is the largest known. It is twelve inches in diameter. There is a grapevine that would give it a close rub on a point in the St. John's River, near Tocoi, Fla. It grows between the roots and twines among the branches of a live oak, the trunk of which measures eight yards in circumference.



RIVERSIDE RESIDENCE AT MAIDENHEAD—E. H. BOURCHIER, ARCHITECT.

[COUNTRY GENTLEMAN.]

THE ADORNMENT OF HIGHWAYS.

The proverbial unattractiveness of country highways is a matter of serious consequence to farmers. There is no reason why they should be so barren and forbidding other than the lack of interest in improvement and indifference to the charms of nature on the part of adjoining land owners. Highways admit of adornment which shall be at the same time inexpensive and attractive Many of the principles of landscape gardening can be applied to them. But here, as elsewhere, there must be *appreciation of nature* before any adornment can give pleasure to the beholder. It is strictly true that the most of landscape gardening lies under a

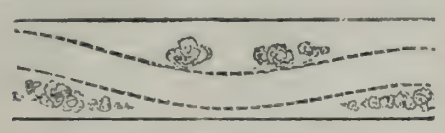


Fig. 1.

man's hat. The man who sees no beauty in wild nature can see none in gardens. His eye may be arrested by a gaudy display of colors or by a tree fantastically trimmed, while yet there is no response to the principles of true beauty. There is a depth of meaning, of expression, in nature which is independent of mere form and color. Many self-styled landscape gardeners are responsible for hiding the very soul of the art which they profess to cultivate. They confound intricate designs of foliage, plants, and other works of mere manual skill and fashion with landscape gardening. Such men have not received the first perception of the beauty which resides in landscape. To adorn, as I use the term here, has no reference to the mere cultivation of flowers and other plants. It refers rather to the improvement of natural scenery.

To the landscape gardener the most conspicuous fault of the ordinary highway is its *straightness.* Straight walks and drives can never give that pleasing variety of scene which comes almost unavoidably from those which are curved. The leading feature which a straight highway presents is an almost endless stretch of bare and glaring soil. To one accustomed to admire scenery, this stretch of roadway is often painful. Even those who have little appreciation of nature must feel an indefinite sense of relief and pleasure when they come upon a bit of verdant road which curves along a stream or winds about a lake or hill. Yet the highway is made for use, and the landscape gardener has learned that the useful must be made the beautiful. Utility is of first importance. Straight highways are, therefore, to be maintained. Yet there may be, and should be, exceptions to this rule. An extreme and persistent desire to make every highway straight throughout its whole length is to be discouraged. It is often less expensive and better to go round a small steep hill than to drive over it—the distance may be no greater, and the traveling will be easier. Certainly, as a rule, the landscape will be better. It is often better to skirt a ravine or river than to bridge it. Mr. Potter, in his excellent book on "The Road and the Roadside,"* speaks as follows on this important subject:

"But, in any event, in road making mere straightness should always yield to a level grade, even if thereby the distance is greatly increased, for on a good grade a horse can draw rapidly and easily a load which it would be impossible for him to draw on a steep grade. It is an accepted maxim by road engineers that the horizontal length of a road may be advantageously increased, to avoid an ascent, by at least twenty times the perpendicular height which is to be thus saved; that is, to escape a hill a hundred feet high, it would be proper for the road to make such a circuit as would increase its length two thousand feet."

In many cases the driveway may be made to curve,

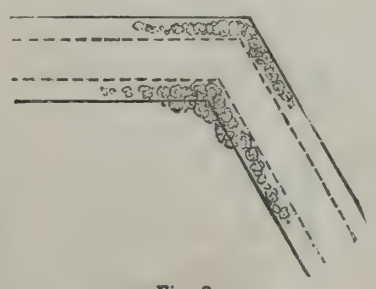


Fig. 2.

although the highway fences are straight. In this way a curve can often be introduced which shall be sufficient for all purposes of landscape gardening. Such a series of slight curves is represented by the dotted lines in Fig. 1, the continuous lines representing the fences. The shaded portions represent groups of trees and bushes. Such curves occur in very many highways, entirely independent of any plan. The traveler naturally follows the best portion of the highway. A slight turn in one direction or the other may in this way serve convenience as well as beauty. Such curves are often a great convenience in the descent of a hill. It is by no means necessary that the driveway always follow the center of the highway, yet the curve itself has no beauty if the planting is not properly done.

People commonly overestimate the length of a gently curved drive as compared with a straight one. Mr. Potter writes again as follows:

"Moreover, we are told by competent engineers that the difference in length between a straight and a slightly curved road is very small. Thus, if a road between two places ten miles apart was made to curve so that the eye could nowhere see further than a quarter of a mile of it at once, its length would exceed that of a perfectly straight road between the same points by only about one hundred and fifty yards."

The sides of rough and broken highways should be graded where thick planting of trees and shrubs is not to be made, so as to allow a mowing machine to pass over them. The sides should not be leveled to any definite grade, as such grade would be both expensive and usually unsightly. The surface should be allowed to retain its general bold dips and rises. If a ditch must be cut on one or both sides of the driveway, it is not often possible to grade so as to allow the use of a mowing machine. Yet most ditches are too narrow. A ditch with very gently sloping, sodded sides and a sharp, peaked bottom is commonly the best for all purposes. It is not apt to wash, and it presents a better appearance than a narrow ditch. It is often advisable to make the driveway nearer one side of the highway, so as to allow room for a broad ditch on the other side. But here, as in the case of a general lay of the highway, the grade should not be uniform for any great distance. The ditch should vary in width and in direction of the sides. This variation need not be a studied one, however. The ditch should simply take the most convenient shape compatible with the ends in view.

The roadside in general should be seeded. If the highway is pastured, June grass will be best. If the sides are to be mowed, timothy may often be sown to advantage. The adjoining residents should mow the highway once or twice a year. The hay obtained will pay well for the trouble, or if the grass is too dusty for feed, it may be used for mulch or other purposes. If weeds grow close along the driveway, a mowing ma-

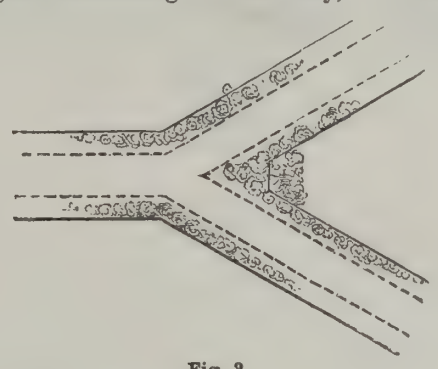


Fig. 3.

chine should be employed occasionally to cut them off.

The proper planting of highways requires taste and study. In general, it may be said that along short stretches of straight and level highways, trees may be planted in rows and at regular distances, but on crooked or uneven highways the planting should be largely in groups. Rows of trees always give the best effect if but one species and one age be represented. A row is always formal, and any irregularity in it spoils much of its beauty. The difficulty in rearing many trees of similar habit and size is the leading objection to rows for level and straight roadsides. The introduction of groups allows of great variety in planting. Many kinds and sizes of plants may be used, and the form of the group may be varied to suit any circumstance. Good groups are never formal or monotonous. They are natural. Bushes should be much employed, especially for the lower places or the borders of groups, while high trees should be planted on the eminences. This arrangement exaggerates the appearance of unevenness of the surface, and, therefore, heightens the effect by increasing variety. These groups must necessarily be long and narrow in most cases. If the adjoining land is inarable, however, they may often extend beyond the limits of the highway. If pastures join the roadside, trees may be planted on their borders and afford a grateful shade for live stock. In the vicinity of the residence, groups may often be extended into the grounds to good effect, to serve as a part of the private planting. Yet a long and very slender group, confined wholly within the highway, may be made attractive. Some of the natural groups which spring up in fence rows are very handsome and may serve as models. A group ten feet wide may be composed largely of small growing trees and shrubs. If it is very long, say seven or eight rods, a few large growing trees, as maples and elms, may be introduced, especially if the land lying adjacent to the highway bears no trees. An isolated group may be planted more thickly than one which stands against an orchard or other body of trees. Groups of bushes are especially in place along watercourses, and they may often encroach close upon the driveway with good effect. In fact, some of the most attractive highways are those whose sides have been allowed to grow up to bushes. They are less dusty and much cooler in summer, and warmer in winter, than the ordinary so-called "improved" highway. Many highways are robbed of all their beauty by the overscrupulous desire to mow bushes and cut away the brush. In most cases these roadsides will grow up to weeds, which will be positively unsightly. Intelligent people should see that a person who is likely to have the common spasmodic

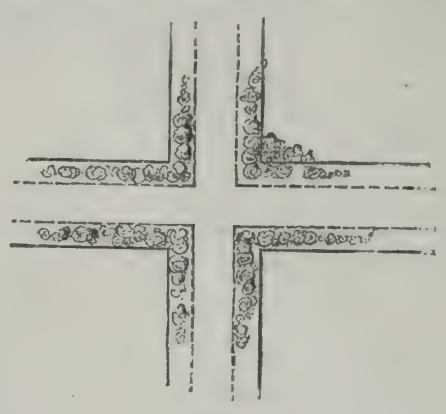


Fig. 4.

relish for improvement, alternating with long periods of slovenly neglect, is not elected pathmaster.

The most conspicuous groups should be upon the lowest and highest areas, along the bends and curves in the road, and at angles, forks, and corners. If near the curves or angles, they should be so placed as to hide the road in advance. This is illustrated in Fig. 1. The traveler on this road cannot see much of the highway directly ahead of him, neither can he look across the curves and see the road at points beyond the groups. His eye is arrested by pleasant views and restful plantings. The planting of an angle is represented in Fig. 2, and two angles and a fork in Fig. 3. In the case of the sharp bends or forks, the groups often extend into the adjoining fields, as long corners cannot be easily tilled. Four corners can be variously planted. It is sometimes possible to plant on each angle, as in Fig. 4, though in most cases this is neither feasible nor desirable. Here, as everywhere, the nature of the planting must be governed largely by the views to be had of the surrounding country. Fig. 5 represents good planting at the right-angled junction of a country road with another and more important one. Not only are the two corners planted, but a group is located along the main road just opposite the entrance of the other. In this position the group marks a fitting termination for the minor road. The travel on most minor roads at such junctions veers so far to the sides that a triangular piece is left between the three driveways, usually ten to fifteen feet long on each side. When such an untraveled space occurs, it should be made to bear a group of small trees or bushes.

L. H. BAILEY, JR.

Michigan Agricultural College.

* See *Country Gentleman*, 1887, p. 784.

Stiffness in Girders.

In designing girders, particularly those of the lattice form, care should be taken not to confound the two elements of stiffness and strength. The absolute strength of a girder may be accurately determined by pure theory, but it is only practice and experience which can correctly guide us in employing such forms of iron as will supply along with the requisite strength a very considerable amount also of rigidity. We should design, principally, with an eye to the strength of the structure, and add or modify according as may be necessary for the stiffness; or, what amounts to the same, we should design chiefly as if for a uniform load

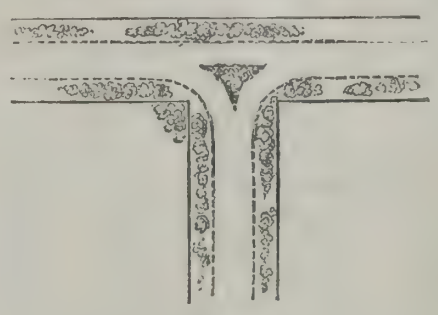


Fig. 5.

at rest, and then modify the design on the supposition that the load is movable and variable. No portion of material in a girder acting solely the part of a stiffening piece can be considered as an inherent portion of its absolute strength. It only adds to its strength insomuch as it prevents the calling into play of uncertain and varying forces (other than those provided for by theory), and which, if not resisted, would endanger the stability of the structure. It has been mentioned before that no mere stiffening iron can be included in the calculations respecting the strength of a girder, and it should be kept in mind that a girder may be very strong and yet very insecure, while again it may be very rigid and yet very weak.—*T. Cargill.*

VILLA ON THE SQUARE OF THE BOIS DE BOULOGNE, IN PARIS.

The specifications called for the residence of a private gentleman who desired to have his entire set of apartments on the same floor with the reception rooms, to avoid the necessity of going up and down stairs.

The ground put at the disposal of the architect was of the form of an irregular trapezium, with the smallest exposure on the principal facade. How successfully Mr. Sauvestre, the architect, has solved the difficult problem may be judged by a study of the plans, and the style of construction successfully combines the picturesque with the practical.

The building comprises a basement reserved for the uses of the servants; the first floor comprising large reception room and the private apartments of the owner, consisting of a bed chamber, study, salon, dining room, etc., staircases and hallways. The second story is given up to guest chambers.

The heights of the ceilings of the various apartments on the first floor vary with the use to which they are put, and each is treated to a different style of decoration. Thus the dining room, which is Flemish in decoration, is 14 feet in height, the study (renaissance) 16 feet high, while the grand salon is 20 feet high.

The grand staircase is treated in the style of Louis XIII., and is lighted by a domed skylight. We give two perspective views of the building, so as to give a good idea of the effect and arrangement of the angle of the extension at the left of the entrance. The total expense of construction was 230,000 francs, or about $46,000.—*La Semaine des Constructeurs.*

The Temple of Soleb, Ethiopia.

The temple of Soleb affords the lightest specimen I have seen of Ethiopian or Egyptian architecture. The sandstone of which most of the columns are composed is beautifully streaked with red, which gives them from a little distance a rich and glowing tint. The side and posterior walls have almost entirely disappeared, and the roof (for the adytum has been completely covered) has everywhere fallen in, so that there remains no ponderous heap of masonry to destroy the effect of eleven beautiful and lofty columns, backed by the mountains of the desert or by the clear blue horizon. We were no longer contemplating a gloomy edifice, where heaviness is substituted for dignity, height for sublimity, and size for grandeur; no longer measuring a pyramidal mass of stonework, climbing up to heaven in defiance of taste and of nature. We seemed to be at Segesta, at Phigalea, or at Sunium, where lightness and color and elegance of proportion, contrasted with the gigantic scenery about them, make the beauty of the buildings more lovely and their durability more wonderful. There is no attempt in them to imitate or rival the sublimity that surrounds them. They are content to be the masterpieces of art, and therefore they and nature live on good terms together and set off each other's beauty. Those works of art that aim at more than this, after exhausting treasuries and costing the life and happiness of millions, must be satisfied at last to be called hillocks.—*G. Waddington.*

SNOW HALL OF NATURAL HISTORY, AT LAWRENCE, KANSAS.

The legislature of the State of Kansas, during its biennial session of the year 1885, appropriated fifty thousand dollars for the purpose of erecting a natural history building for the University of Kansas. The erection of such a building was rendered imperative by the extensive botanical, entomological, zoological, and geological collections brought together under the supervision of Prof. F. H. Snow, whose connection with the institution dates from its foundation in the year 1866. The building was completed in the autumn of 1885, and was formally named and dedicated to the purposes for which it was erected on Nov. 16 of that year. It has two principal stories, each sixteen feet in height, together with a basement and attic so commodious and well lighted as to make the structure practically four stories in height. The building from basement floor to attic roof is divided into two portions, partially separated from each other by the main entrance hall and stairways. The portion to the west of the entrance is devoted to the exhibition of the various cabinets, while the opposite portion is assigned to the work of instruction. The collections belonging to each department are upon the same floor with the laboratories of that department, easily accessible to both students and instructors. The arrangement of the various apartments is so well indicated in the accompanying plans as to require no verbal description. This arrangement was suggested by Mr. J. H. Emerton, of New Haven, Conn., who furnished the preliminary plans which formed the basis upon which the legislature was solicited to make the appropriation. Mr. Emerton's outlines were placed in the hands of Architect J. G. Haskell, of Topeka, Kan., who completed the architectural adaptations in the matters of construction, light, heat, ventilation, and exterior style in a successful and satisfactory manner. The rooms most naturally grouped themselves so as to form a rectangular building; but, for the purpose of increasing the volume of light and also improving the architectural effect, their form was somewhat changed.

The building is most admirably lighted; the volume being so great that on a cloudy day the occupants of laboratories need not seek proximity to the windows for microscopical work, and the museum halls may have cases arranged in any desired relation. The large museum rooms are lighted on three sides, and necessarily have one side not lighted. To prevent this from being a dark side a plate glass window, eight feet wide and eleven feet high, opposite the center of the unlighted wall, was added to the ordinary means of lighting, and has the effect of giving uniformity of volume throughout the entire space.

The exterior is in the Romanesque style, with rock-face ashlar and cut stone dressings, the stone being from the well known Cottonwood quarries of Kansas. The main approach is by a broad flight of buttressed stone steps under a handsomely decorated portico, the decorations being suggestive of the uses of the building. Numerous stone panels are provided about the building, which may, if desired, be utilized for illustrations of natural history subjects cut in bass relief.

The construction of the building is nearly fire proof. All bearing girders are of iron, and all floors are deadened with mortar on corrugated iron laid between the joists. All partitions are non-combustible, all lathing is of wire cloth, the roof is covered with slate and dressed with iron cornices, ridge and hip rolls. All interior finish is polished hardwood, so that little material is presented to feed combustion.

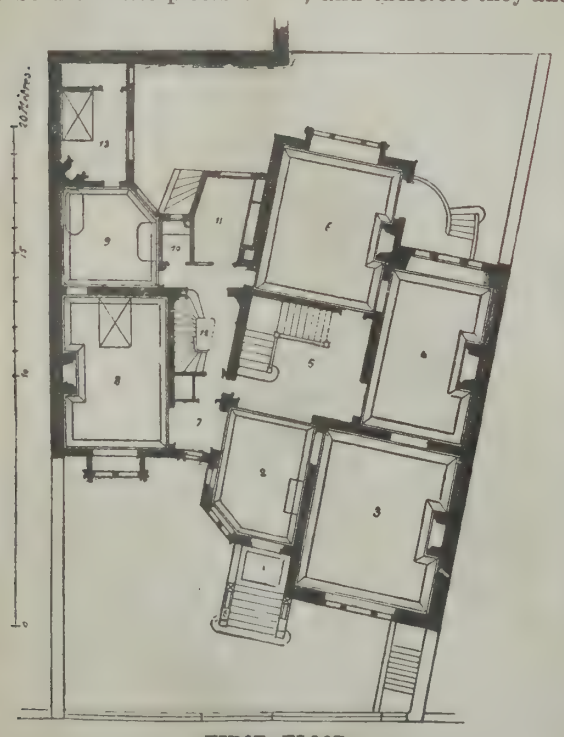
Heating is by steam, the "indirect" method being employed to furnish the rooms with warm fresh air, and the "direct" method for securing proper temperature.

Fresh air is introduced into the building by means of a "plenum" extending under the entire building, and connecting with the outer air by arched openings and areas. Ventilation is accomplished by means of large flues leading from near floor and ceiling of all rooms to a large iron chamber in the attic, in which sufficient radiation is located to insure a successful movement of the foul air through a ventilating cupola to the exterior.

The construction of the building was by contract with McFarland & Son, of Lawrence, and the completion was accomplished within the prescribed appropriation, and without "extras."

We are indebted to *Science* for our illustrations and the above particulars.

A PARISIAN VILLA.



FIRST FLOOR.

1. Entrance. 2. Vestibule. 3. Salon. 4. Study or office. 5. Grand staircase. 6. Dining room. 7. Passageway. 8. Bed chamber. 9. Dressing room. 10. Toilet. 11. Office. 12. Back stairs. 13. Servants' room.

The Architect of Rome.

The social and political reform of Augustus had its material counterpart in the construction or renovation of the public buildings of Rome. The restorer of the commonwealth was also the architect of the city. The well-known epigram, in which Augustus boasted that he had found Rome brick and left it marble, is justified by the businesslike details of his achievements in masonry, still legible in the inscription of Ancyra. The Augustan edifice which stands first in order in this catalogue is the Curia, called, after his adoptive father, the Curia Julia. Near the Curia stood the Chalcidicum, which Mommsen confidently declares to have been a temple sacred to Minerva Chalcidice, though this is by no means the universal opinion. On the Palatine, where Augustus was born, stood the imperial residence, constructed soon after his famous victory. In the same patrician locality rose the temple of Apollo, the radiant god who had been his champion in the great fight against Antony, and had veiled his face in horror at the fall of his father, the murdered Julius. This temple was celebrated for its magnificence.

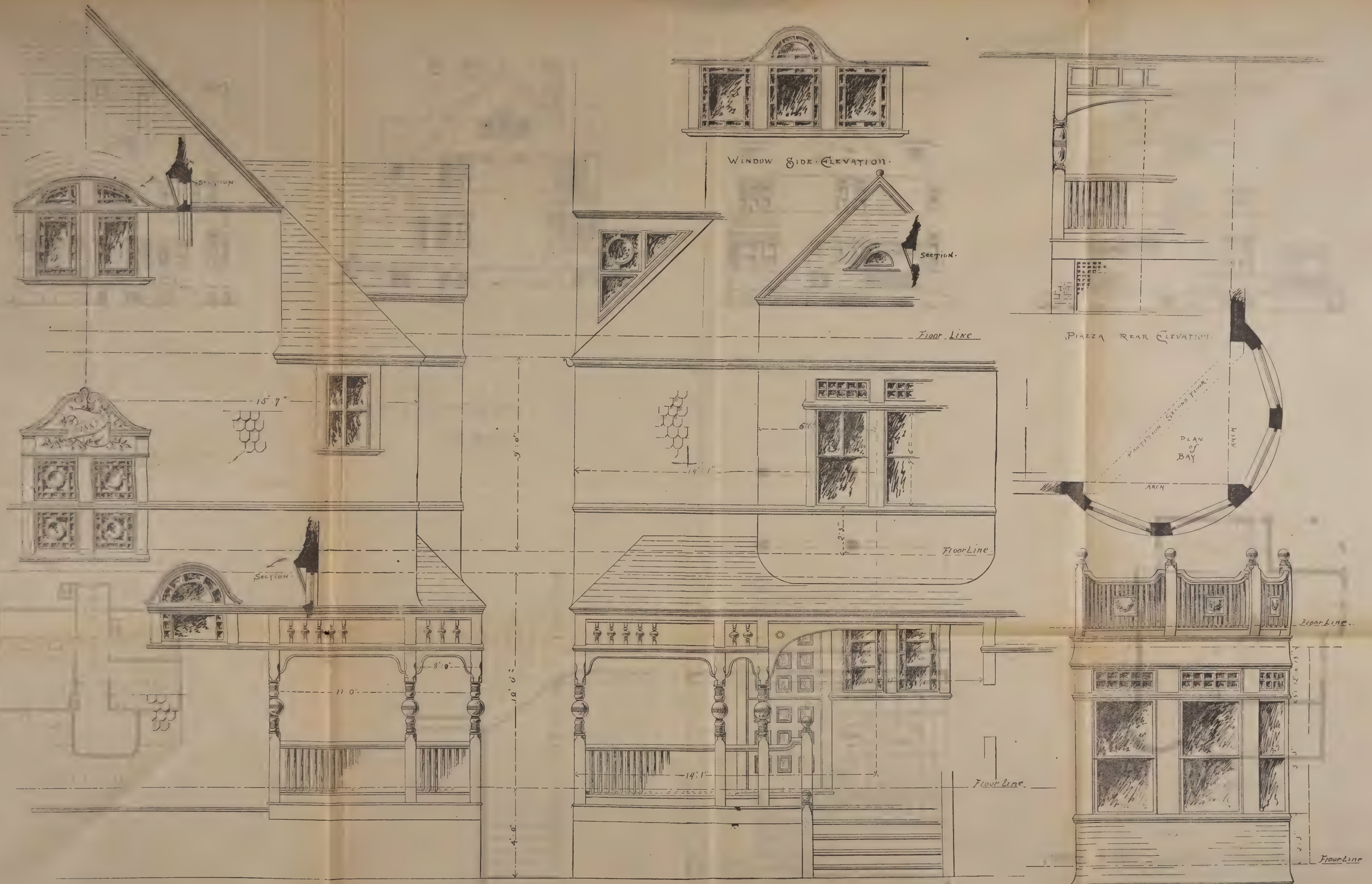
SECOND FLOOR.

14. Grand staircase. 15. Passage. 16. Bed room. 17. Dressing room. 18. Bed room. 19. Bed room. 20. Dressing room. 21. Toilet chamber. 22. Servants' stairs. 23. Bed room. 24 and 25. Servants' rooms

A Colonial Dwelling for $5,500.

FIRST STORY PLAN.

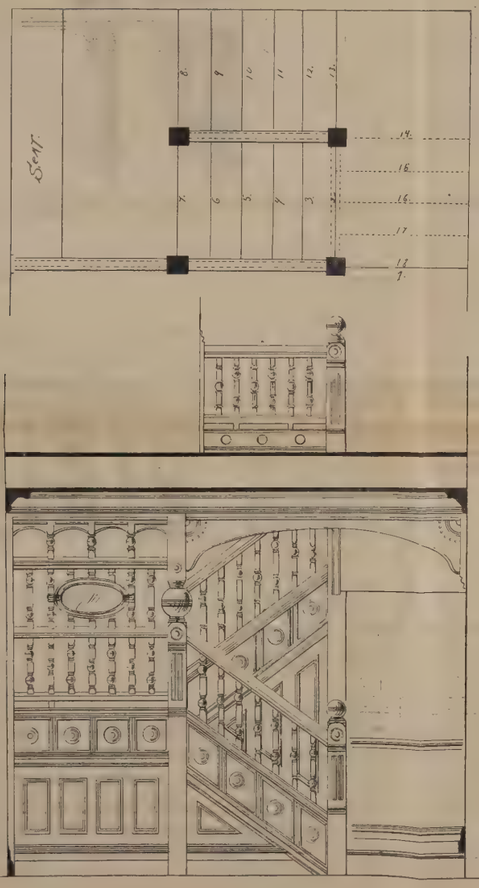
SECOND STORY PLAN.



Two Dwellings at Orange, New Jersey.

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for February, 1888.

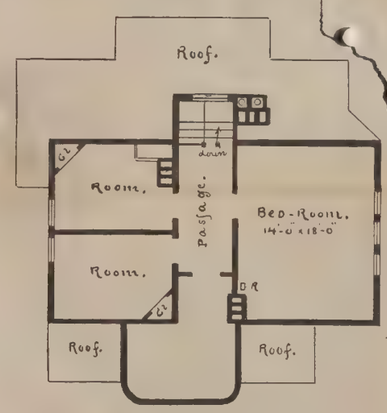
PLAN of STAIRCASE.



HALF INCH SCALE DETAILS

STAIRCASE.

CELLAR PLAN.



ATTIC PLAN.

STAIRCASE

Two Dwellings at Orange, New Jersey.

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for February, 1888.

Two Dwellings at Orange, N. J.

FIRST STORY PLAN.

SECOND STORY PLAN.

To the portico which encircled it, Propertius, in a dainty little poem, applies the epithet golden. The columns, more than fifty in number, were of African marble. Between them stood the statues of the daughter of Danaus and that of the father of the maiden band with sword unsheathed. Here, too, was a statue of Apollo playing on a lyre, while around the altar, vivid as reality, stood the sculptured oxen of Myron. In the interior was another statue of Apollo, between that of his mother Latina and that of his sister Diana, the work of Scopas, Cephisodorus, and Timotheus. The temple itself, of Parian marble, rose dazzlingly white, as in the verse of Virgil. The gates were of ivory, blossoming with storied life. Over the pediment might be seen the chariot of the sun. Adjoining the temple was a valuable library, stored with the choicest product of the intellect of Greece and Rome.

At the southeastern extremity of the Forum rose, at the bidding of Augustus, the shrine of the deified Dictator, with its front to the Capitol. At the entrance of the valley of the Velabrum stood the Lupercal, rebuilt by Augustus. Over a precipice 80 feet in height rose the temple of Jupiter Capitolinus, restored by him. On the same imposing elevation rose two other shrines of the Olympian lord, that of Jupiter the Spoil-bearer and that of Jupiter the Thunderer. The latter had bells hanging to its pediment, and was an offering of gratitude for a providential preservation in a journey. When a slave who had preceded the emperor's litter with a torch had been struck dead by lightning, Augustus himself had escaped unhurt. On the Quirinal rose the new temple of Quirinus, the celestial name of Father Romulus, who was believed to have ascended into heaven. On the Aventine stood the temples of Minerva, of Juno Regina, and according to Orelli, who is followed by Mommsen, of Jupiter Libertas, the Zeus Eleutherios of the Greek text. On the summit of the Via Sacra rose the temple of the Lares; the Velia was beautified by that of the Penates. On the hill which he had selected as a site for his own residence Augustus erected the temple of Juventus, or Youth, and that of Cybele, the Great Mother. In the Circus Maximus he rebuilt the Pulvinar, on which reclined the images of deity, and where the imperial family sat as spectators of the public games. In the Campus Martius he reconstructed the stone theater formerly erected by Pompey, fragments of which, it is said, are still recognizable on the Palazzo Pio and the adjacent edifices. Behind the Curia Julia stood the Julian Forum, which the great uncle had commenced and the great nephew finished. Adjoining the Julian Forum was that of Augustus, one of the finest of his public works. Near it rose the magnificent temple of its presiding deity, Mars the Avenger, who thus for the first time was admitted as a resident into the city, in recognition of the distinguished service he had rendered in exacting an appropriate retribution from the murderers of Cæsar. To enumerate all the architectural exploits of Augustus is impossible. In his sixth consulship alone this indefatigable worker built or restored no fewer than eighty-two temples. No wonder that Livy celebrated him as *templorum omnium conditor ac restitutor*, that Horace complimented him as the renovator of the fallen shrines and blackened images of the gods, or that Virgil beheld in the three hundred fanes of his magnificent patron an immortal attestation of his religious devotion.—*W. M. W. Call.*

Worthless "Fire Proof" Buildings.

It is a satisfaction to find that the Americans are certainly giving lessons to the rest of the world in matters of construction, if not of art. Perhaps the art will come later. Not long ago a great fire took place in Berlin, totally destroying a structure composed wholly of brick and iron, and built with the solidity characteristic of German work. The building was a storage warehouse for the great Berlin express company, and was about a hundred feet wide and a hundred and fifty feet long, six stories high, with a small courtyard in the center. A heavy brick wall divided it through the middle, and the floors were all made with brick arches, turned between iron beams, which rested on the walls and on ranges of iron girders supported by cast iron columns. The doors in the partition wall were of plate iron.

We have learned by experience the vulnerable points of such a structure, but to the Germans, unaccustomed to destructive fires, it must have seemed as fire proof as it would have to us thirty years ago. Five months after the building was substantially completed, one or two temporary openings were made in the third story floor, for the purpose of finishing some part of the work, and while these were still open an accident occurred, by which fire was set to some goods stored in the third story. The flaming brands immediately fell through the holes in the floor, setting fire to the goods in the next story below, which were mostly cotton and woolen materials, and although the fire engines arrived in five minutes after the fire started, they were too late to be of any service.

Five minutes seems a short time for a fire starting in a little bundle of dry goods to accomplish the destruction of a huge building, in the construction of which there was not a trace of inflammable material; but no sooner had the nearest bales become kindled than the iron beams over them, quickly heated by the flames, expanded, violently wrenching the girders, and in many cases breaking off the capitals of the columns. In this effort the beams themselves were bent and twisted, letting the brick floor arches fall; and so quickly did this effect occur that many of the floor arches had fallen out before the engines arrived, five minutes from the setting of the fire.

The collapse of the arches not only opened a passage upward for the flames, but piled broken cases, torn cloth, and other combustibles, in the best condition for speedy kindling, upon the blazing goods beneath, and the west half of the structure, in which the fire first caught, was soon a mass of flames. The eastern half was cut off by means of the iron doors, all of which had been duly closed, but these soon became red hot from the action of the fire behind them, and in that way set fire to goods lying against them, and they also soon warped enough to let the flames through, and hasten the effect, so that in one hour from the first alarm little remained of the western half of the building but the tottering outside walls, a large portion of which had already fallen, while the three upper stories of the eastern half, notwithstanding the brick partition wall and the iron doors, were totally destroyed, and the lower stories nearly ruined by the fall of the upper floor arches.

On examining the place after the fire, it was found that out of one hundred columns which originally held the floors, thirty-eight had been thrown completely out of their places, while thirty-four more, although they remained standing, were so broken or bent as to be useless, the only ones still fit for service being those in the lower stories of the eastern half of the building. The girders were formed of iron beams, eighteen inches deep, and these were in some places twisted like corkscrews by the strain which they had undergone. An expert commission was immediately appointed to study into the causes of the fire, and made a report expressing the opinion that no building could henceforth be considered fire proof unless the flanges of iron beams, and all portions of iron columns, were "covered by some non-conducting material," as "is now commonly done in such structures in the great cities of the United States of America."—*Amer. Architect.*

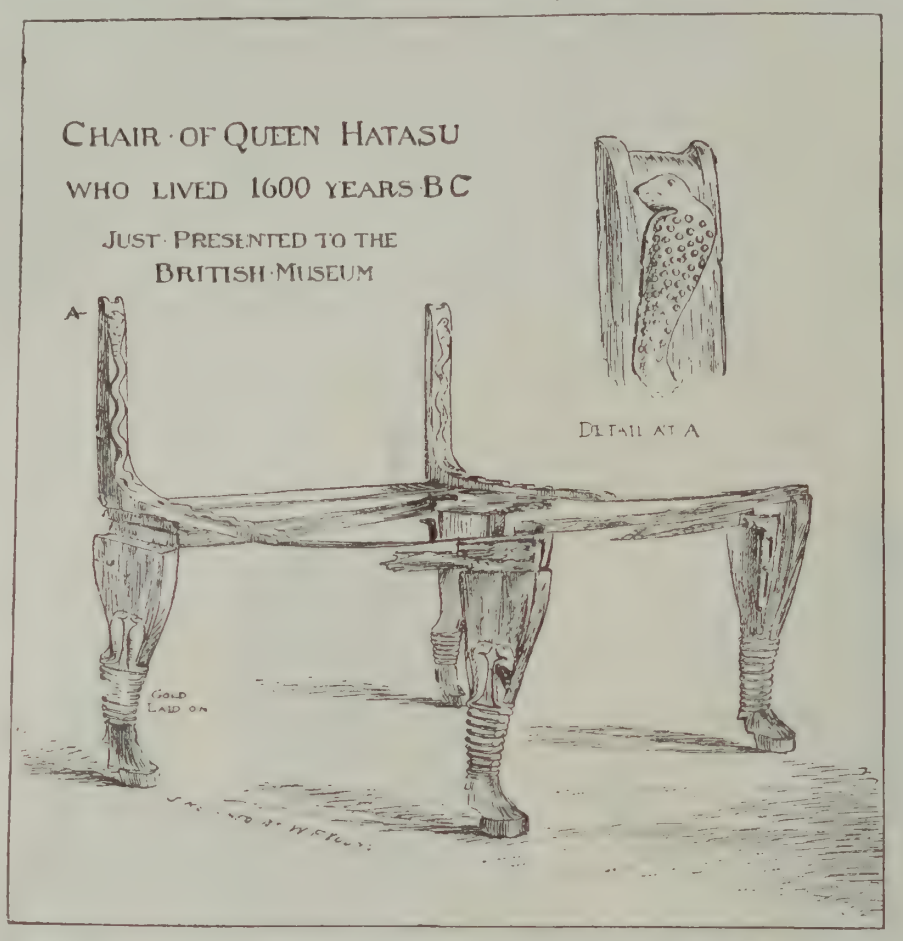
VILLA ON THE SQUARE OF THE BOIS DE BOULOGNE, PARIS. DESIGN OF M. A. FATALOT. M. S. SAUVESTRE, ARCH.

Compound for Patching Stone.

The restoration of some of the most important stone structures in Paris has been mainly accomplished by means of a metallic cement invented by Professor Brune. It consists of a powder and a liquid, the first composed of two parts by weight of oxide of zinc, two of crushed limestone of a hard nature, and one of crushed grit, the whole intimately mixed and ground, ocher in suitable proportions being added as a coloring matter. The liquid employed consists of a saturated solution of zinc in commercial hydrochloric acid, to which is added a part by weight of hydrochlorate of ammonia, equal to one-sixth that of the dissolved zinc, and this liquid is diluted with two-thirds of its bulk of water. In using the cement, one pound of the powder is mixed with two and a half pints of the liquid. The cement harden[illegible] and is of great strength.

THE CHAIR OF QUEEN HATASU.

We illustrate here what is probably the most venerable piece of furniture in the world, viz., a "royal Egyptian throne, of the above named queen, Hatasu, a lady who lived and reigned in the Nile Valley some 1,600 years before Christ and 29 years before Moses." The throne, or rather the remains of it—as what is left is in a dilapidated condition, and has to be secured with brass bands—is made of what appears to be lignum-vitæ, is of a dark color, like the cocus-wood, and is inlaid over all the carved portions with gold plates. The two sacred serpents, shown on the two uprights at the back, however, are not treated so, but, as our detail illustrates, with little silver rings sunk all over them—probably a conventional rendering of snake-skin. This interesting throne chair is in the upper gallery of the Egyptian Court, and has just been presented to the British Museum by a gentleman in Cheshire.—*Building News.*



THE GIGANTIC LUMBER RAFT.

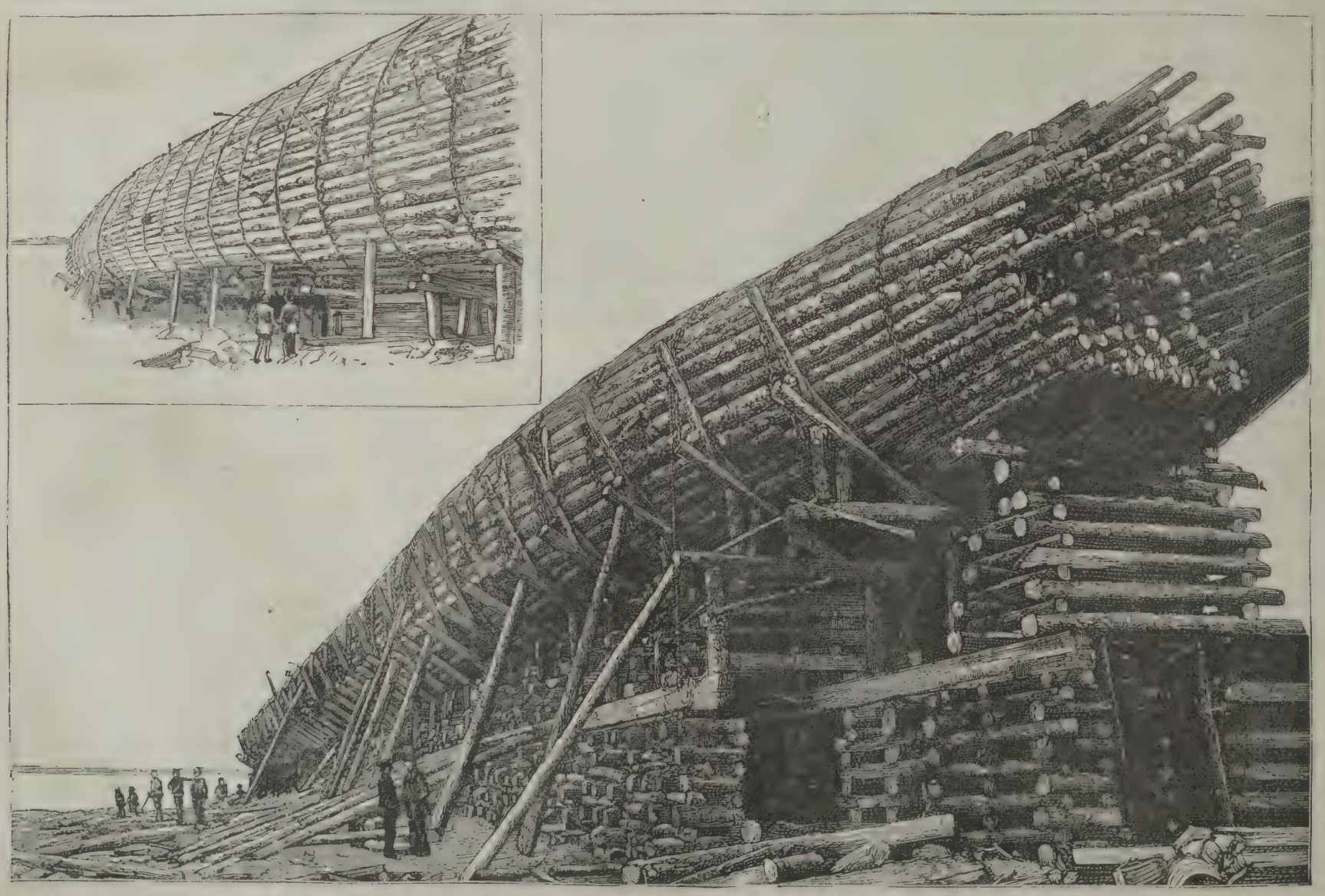
Considerable difficulty has been always experienced in the transportation of the largest and longest logs from Nova Scotia to the various towns in the United States. Vessels trading to Nova Scotia could carry none exceeding 65 feet, and those of greater length were brought by rail—an expensive method, as three or four cars were needed to carry one log. Consequently Mr. James D. Leary, of New York, determined to try the experiment of having a monster raft constructed, and towed from Port Joggins to New York. The raft was duly launched on November 15 at Two Rivers, Nova Scotia, and was composed of 25,000 sticks of spruce and pine timber, from 35 to 95 feet in length, and a great quantity of beech, birch, and maple timber, making a total of 4,500,000 feet. The dimensions of the raft were 585 feet in length, 62 in width, and 37 in depth, and it was built after a new patented method, and with tapering ends. The whole mass was carefully bound together with strong chains to keep the timber from spreading out, working apart, or drifting back when being towed. The building was the result of several years' planning and experiments. The cost of the raft when launched and ready to tow was about 6,400*l.* (the value together with the timber being 30,000*l.*), and the contract price for towing it to New York was 700*l.*, exclusive of hawsers. Great care was taken to launch the raft successfully, and forty-five men were employed for six months in constructing permanent ways 1,200 feet long, which would last for years and serve for a series of rafts. A powerful steamer, the Miranda, of 1,500 tons burden, was chosen to tow the raft, and had a 15-inch hawser which was fastened to the center chain, which ran the whole length of the raft, and two 10-inch hawsers passing on either side. The tow was 1,000 feet astern of the steamer. The start was made on November 30, and for some days all went on very well, but on December 18 a violent gale caused the hawsers to part about forty-five miles off Nantucket Island, and the steamer completely lost sight of the raft. As, however, it was presumably drifting in the direct road for oceanic steamers, the United States government sent a steamer, the Enterprise, to search for the dangerous derelict. The raft, however, appears to have broken up, as portions were found 350 miles S.S.W. of Sandy Hook, and 135 miles from the spot where it was abandoned. None of the logs continued to be lashed together, but floated singly, spreading over a wider surface as they traveled with the tide. They were not, however, in the track ocean steamers, and were regarded as comparatively harmless, the commander of the Enterprise reporting that the logs were drifting over an area of 1,000 square miles, being from a quarter to half a mile apart. This optimist opinion is not shared by other sea captains, who consider that a vessel striking one of these huge logs might suffer considerable damage.—*London Graphic.*

Other Timber Rafts.

In an article entitled "The Nova Scotia Raft and Its Progenitors," the *Timber Trades Journal* refers, in the following interesting manner, to early large timber rafts:

In 1792 a raft containing about 1,000 tons of timber was built at Swan Island, in the Kennebec, by Dr. Tupper, a somewhat noted eccentric character. It was made by treenailing square timber together in the form of a ship's hull, and was ship rigged, the intention being to send her across to England. At that time no manufactured lumber was admitted to the ports of Great Britain; hence the timber in the raft was simply squared with the ax, to make it stow well. The ship or raft lay at Bath for some time, it being difficult to get men to go in her. She finally went to sea, however, carrying a small vessel on her deck; but off the Labrador coast her crew became frightened by bad weather, and abandoned her. She was afterward boarded by men from a passing vessel and found to be in good order, and it was suspected that she was deserted without sufficient cause.

Two other similar attempts were made from the Kennebec, and both vessels went safely across, but foundered on the English coast, under the same suspicions of fraud as in the case of the Tupper ship. In 1825 the ship Baron of Renfrew was launched at Quebec, having made a previous unsuccessful attempt, when stopped on her way, owing to the grease being consumed by fire from friction. She was towed down to the Island of Orleans and anchored. Her dimensions are given as follows: Length, 309 feet; breadth, 60 feet; depth, 38 feet internally and 57 externally; tonnage, 5,888 tons; draught when launched, 24 feet; cargo on



THE GREAT LUMBER RAFT RECENTLY LOST AT SEA.

board when launched, 4,000 tons of timber. She was ship rigged, with four masts, and was perfectly flat bottom, with a keel of about 12 inches, wall-sided, sharp forward and rather lean aft, and looked more like a block of buildings than a ship. She sailed in August, 1825, drawing 36 feet of water, in command of a Scotchman, a half-pay lieutenant in the British navy. October 27 the Baron of Renfrew drove on shore on the coast of France, near Calais, and went to pieces.

THE E. N. GATES SYSTEM OF HOT WATER HEATING.

We present in this issue an illustration of the Gates system of heating, one that is of much interest, as well on account of its novelty as of its extensive range of adaptability to large and small establishments. In the elements of safety and economical application of heat, it presents an important advance.

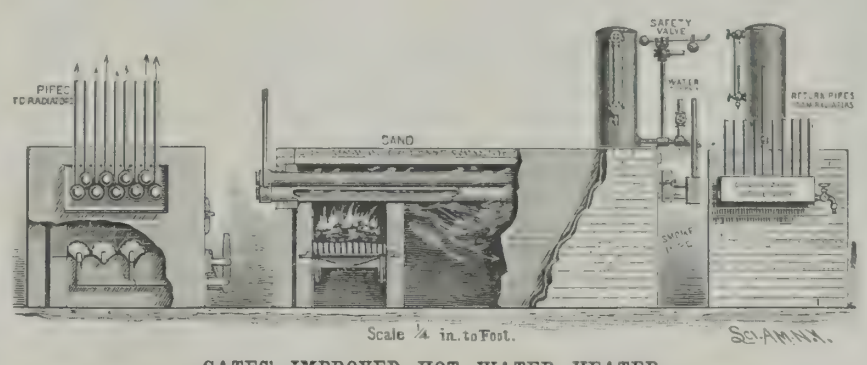
The water is heated in tubes, a nest of which forms the boiler. Three inch steam pipe is adopted for this part of the system. It is cut to a uniform length of eight and one-half feet, for ordinary house heating, and the lengths are connected, side by side, in nests of any desired capacity. The number of such pipes may vary from five to eleven, or more. These are supported in a horizontal position in a brick chamber. The whole is surrounded by an air jacket to prevent loss of heat, while a thick bed of sand is used on the top for the same purpose. Within the chamber the grate is placed. It is extra heavy and of the rocking type. Fire brick, 4½ inches in thickness, are used to line the heating chamber. This arrangement secures the best results. As no water surface comes in direct contact with the fire, as in the ordinary type of boiler, the fire will "keep" for many hours.

From one end of the nest of tubes the hot water pipes for the radiators rise and supply them with hot water. From the radiators the return pipes descend and are carried to a mixing or equalization chamber. In this the water from all the radiators mingles before it returns to the boiler. It enters at the ends of the tubes opposite to the point of delivery. The effect of this is that a constant temperature of the return water is secured, otherwise at one moment comparatively hot water from one radiator would enter the boiler, followed, perhaps, by a current many degrees cooler from another. This feature conduces to the even and economical working of the boiler, and prevents all shocks and strains due to uneven temperature.

In order to still further increase the economy of fuel, the principal of recuperation is introduced. The hot gases from the furnace, instead of at once passing up the chimney, after doing their work in heating the boiler, come in contact with the inlet tubes. Around these they circulate, and warm the incoming water before it enters the boilers. The waste products of combustion are only delivered to the chimney when they have exhausted much of their otherwise waste heat in thus warming the feed water. The strains produced by the admission of cold water into a boiler filled with hot water are universally recognized as destructive.

The Gates boiler being of the tubular type is almost indestructible, and is free from liability to injury even from such strains. But none the less will the feature of good practice be discernible in the hot water feed. This is a most important innovation. The condition of the water supply can be seen at a glance without the necessity of ascending four or five flights of stairs. If, through carelessness on the part of the attendant, the water should overflow, the leakage will take place in the cellar, under which there are no ceilings to be ruined by its escape.

A valve of minute opening is introduced in the system that allows enough circulation to take place through the radiators when they are shut off to prevent them from freezing. The air valves on the radiators are of such construction that they can only be opened by a key. This precludes the possibility of unauthorized persons manipulating the valve so as to permit water to flow.

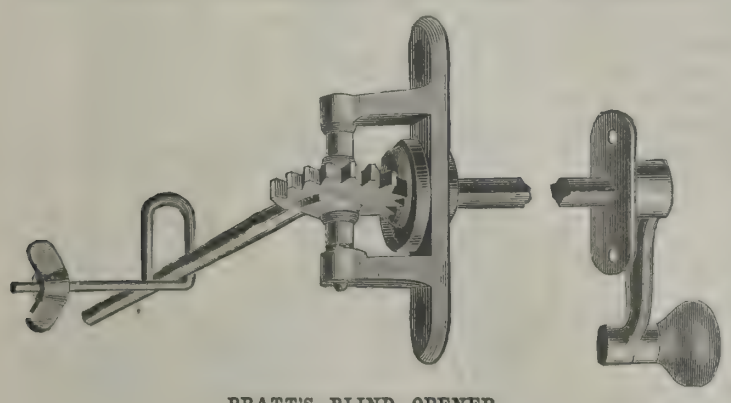


GATES' IMPROVED HOT WATER HEATER.

The above summarizes the general points of the system, and, with the engraving, makes its leading features clear. For further information the patentee may be corresponded with. His address is E. N. Gates, Fitchburg, Mass. Fuller particulars than we have space for will be furnished by him.

To Braze Brass to Copper.

Plumbers may find this formula for brazing brass to copper useful. It is taken from a foreign exchange. "The solder which unites the two metals must be soft brass, which will melt much easier than the brass which is to be joined to the copper, otherwise the work would melt at the same time as the solder. The edges of the work must be carefully cleaned, and then the parts brought together into their proper place and secured with iron wire. The flux to be used is borax, rubbed up in water until it is like a thick cream. The solder, which may be in the form of beads, strips, or wire, is next distributed along the joint. The amount of heat and the method of applying it depend entirely upon the size of the work to be done. If the work is small, the blowpipe is by far the most convenient and safest, because if the heat is too great, there is danger that the brass part of the work will be melted. The heat is to be applied until the solder melts. As soon as the solder melts or 'flushes' the work should be struck, so as to jar it just enough to make the solder flow into the joint. To find out whether the solder is soft enough for the work, a piece may be laid upon a bit of brass of the same kind as that of which the work is made, and put it in the fire. If the solder melts considerably sooner than the brass, it will be safe to use it for the work. If, on the other hand, they both melt about the same time, a softer solder will be needed. We had nearly forgotten to say that the solder can be obtained at any of the stores where small tools for machinists and metal workers are kept, and we think it can be obtained in several degrees of hardness. Spelter solder may also be used for the purpose.



PRATT'S BLIND OPENER.

PRATT'S BLIND OPENER.

This is a simple device for opening and closing blinds and shutters without opening the window.

In common with many others, the Millers Falls Co., 93 Reade Street, New York, have long experimented with these blind openers, but in advance of any others have happened to strike the right thing, which will do the work to everybody's satisfaction.

Whatever hinges are on the blinds, they are not to be disturbed. A screw eye or staple is placed in the middle rail of the blind, and a lever working in this staple moves the blind either way. This opener locks the blind fast at any point where it may be when you let go of the crank. They are put on without going outside of the room, and in a very few moments' time. Full directions go with each set.

The crank and face plate, which remain inside the room, are highly ornamental, being polished and nickel-plated.

The economy in fuel is practically the most important point attained by it.

The radiators in the Gates system are connected by ¾ inch pipes, as these are of ample size. The peculiar disposition of boiler and connections insures so positive a water current that a full supply of water is certain. Somewhere in the cellar the supply and return pipes of each radiator are connected by ½ inch pipes. This insures a circulation, whether any of the radiators are in use or not. If one or two are turned off, the heat which they would receive is, if desirable, delivered to the others. It is all a question of opening or closing the individual radiator valves. Thus the house system is automatic in one sense.

The water tank that keeps the system supplied with water is placed in the cellar. Air pressure is used to give it head enough to work against the water pressure.

FULL plans, specifications, and details, ready for the builder, of any of the houses illustrated in this publication may be had on moderate terms at this office. Special plans and specifications for the erection of buildings of all grades are also supplied by us. Munn & Co., architects, 361 Broadway, New York.

Plans for the alteration and enlargement or improvement of buildings are also supplied.

An Agate Forest in Arizona.

When Geronimo led the frontiersmen such a lively chase in Arizona, he ran better than he knew. In the pursuit the heart of the Apache country was invaded. It was in one of these go as-you-please chases that a cowboy named Adams found himself in the remote and before undiscovered petrified forests of Arizona. As soon as he was able he made his way back and straight to the Governor of Arizona to tell him of the wonders he had found. His story was laughed at.

"Very well," said the cowboy. "If my story is not true, I'll bear all the expenses of the journey there and back."

The story was true, and here, prone in the depths of the lava desert, the governor saw the remains of a forest changed into brilliant-hued, translucent agate, held in form by the petrified bark, every ridge and knot perfectly translated. Such a sight never before greeted the eyes of man. The largest block of agate then known was but thirteen inches across. The governor hastened back. The territory was quickly appropriated under the "placer act" Being on railroad lands, a separate contract was made with the company granting removal of the trees within five years.

Some specimens were sent to Tiffany & Co., and the representatives of the dazed and dazzled company, helpless in the face of what they believed were prospective millions, came on for advice.

"The blocks are valueless, unless you can work them, for this is no child's play. There is but one firm in the United States can do it, if they can. That firm is the owner of the jasper works at Sioux City."

To the jasper-working firm they applied. The representative of the firm said: "We will spend $5,000 in the endeavor to saw across these agate logs five table tops and polish them. If we fail, we will bear all the cost, but if we succeed, give us one-third interest and half the control."

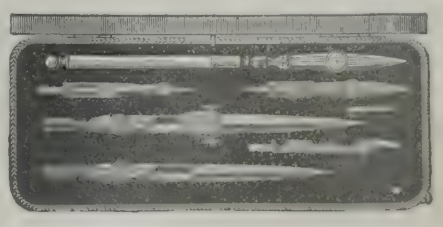
These were considered hard terms, but who knew of any precedents that could regulate the control of a forest turned into flamboyant stone? The owners yielded. The five table tops were successfully cut, and work on the spot was soon in progress.

There has been on exhibition at Tiffany & Co.'s some of these specimens, unparalleled in size and in the brilliancy of the color. Petrified wood is the popular name. In fact, the wood has been disintegrated by water bearing agate deposit, which has replaced the wood, atom for atom, assuming all its vagaries and forms, but illuminating them with resplendent colors.

Mr. James E. Drake, formerly known on the Produce Exchange here, is now in town. He says among the other wonders of this region, the isolation of which is something terrible, are the Aztec remains that are cut in the sandstone. They are among the most interesting of all the Western country, one of them resembling the sphinx. It is the intention of the syndicate, when their own work is further along, to build a branch railroad that shall bring these curious sights within the reach of tourists.

DRAWING INSTRUMENTS.

Among the many pocket cases of drawing instruments offered the public, the one we illustrate in this connection, for sale by G. S. Woolman, 116 Fulton Street, New York, has much to commend it to the use of engineers and mechanical draughtsmen. Though of comparatively low price, the instruments are of the best make, and comprise one pair 3½ inch dividers, with pen, pencil, needle point, and lengthening bar; one pair 3½ inch plain dividers and one drawing pen,



POCKET CASE OF DRAWING INSTRUMENTS.

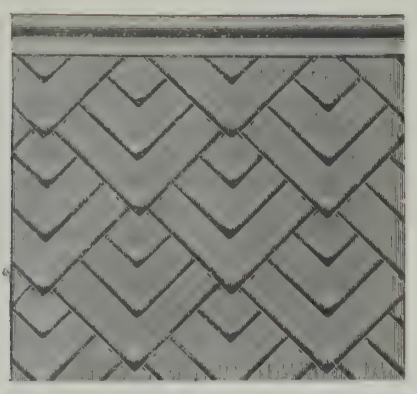
joint and pin, 4½ inches. Mr. Woolman will be pleased to mail his large and very fully illustrated catalogue to any address on application.

A CERTIFICATE of incorporation has been issued to the National Hot Water Heater Co., of Boston, who will undertake the manufacture and sale, in the United States, of the Spence hot water boilers for heating buildings by hot water circulation. These heaters have been made and extensively sold throughout the Dominion of Canada, by Rogers & King, of Montreal.

James C. King, of Montreal, is president, and Daniel Simonds, vice-president and treasurer of the Simonds Manufacturing Co., Fitchburg, Mass., is treasurer. The offices of the company are at 191 Fort Hill Square, Boston.

THE CORTRIGHT SYSTEM OF METAL PLATE ROOFING.

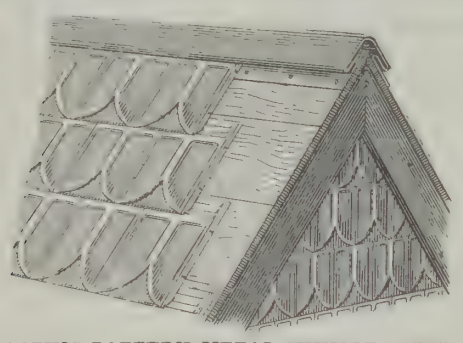
We here illustrate this well known system of roofing and siding buildings. The first engraving shows the Cortright metal tiles as laid upon a roof whose ridge is covered with the Cortright roll coping. In laying such work, the men begin at the ridge and work downward. This leaves the sheathing free for attachment of scaffold, etc., so that the workmen never walk over



SHIELD PATTERN METAL TILES, WITH ROLL RIDGE-COPING.

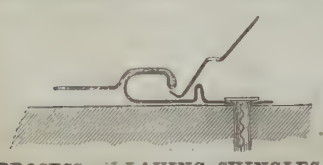
or stand upon the finished work, so as to mar or injure it. As fast as it is done it forms a complete roof, and if a portion only of a roof is covered, no rain can penetrate that part. A concealed tight gutter runs around the four sides of each tile. The joint is expansive.

The Cortright Gothic shingle is shown in the next cut, laid upon a roof which is capped with a Cortright



GOTHIC PATTERN METAL SHINGLE, WITH PLAIN RIDGE-COPING.

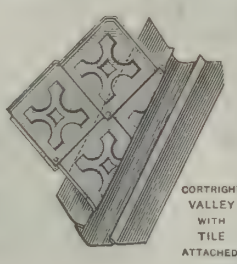
patent plain ridge-coping. The side-lock of this shingle is claimed to embody great advantages, from the point of view of solidity and permanency. As the shingles are laid the side lock is well in view, so that the operative cannot make an error or omission in his work. The sectional views of the lock while making and when complete illustrate its security and simplicity. The long joint insures accuracy and dispatch. The lower edge of the shingle is straight. No offset or projection is necessary to allow for the side lock. This feature is secured by leaving an elevated platform at the top of each shingle whose height is equal to that of the side seams. Upon this the unbent smooth edges of the next shingles rest. Hence a close, unbroken fit is secured for this all-important part.



PROCESS OF LAYING SHINGLES. FORMING SIDE-LOCK.

SIDE-LOCK FINISHED.

These shingles are made in different sizes, and are



SECTION OF SHINGLE SHOWING RAISED PLATFORM.

available for siding gables, for ornamental bands around buildings, and for the many other places in which the architects of the day introduce ornamental shingle work.

The patent ridge-coping is made from one piece of metal. Its shape is shown in the cut. The shingles are inserted into the fold or groove above the nailing flange, and cover the heads of the nails. This is an important and characteristic feature of this coping.

The valley is made also of one piece of metal, and has a double water back. It provides for ventilation of metal in the valley, thus preventing sweating and corrosion.

For further information as to these goods and accessories used in connection with them, the Cortright Metal Roofing Co., Broad and Race Streets, Philadelphia, may be addressed.

Harmonious Combinations of Colors in Ready Mixed Paints.

We are sure that not a small proportion of our readers are aware that what is known in some quarters as the "Colonial" style of decorative house painting is coming more and more into vogue for cottages and small sized buildings at country resorts and in rural neighborhoods. One of the chief characteristics of this style is the generally similar colors used about the time of the Revolution in the painting of the low frame structures so commonly forming the family home at that period, and which consists of a light canary yellow for the body of the house, with white for the trimmings and rich dark green for the blinds. The cheerful and pleasing effect of this combination of colors, particularly when the house is surrounded by trees, is in striking contrast with that produced by the somber dark red or brown which has been quite the fashion for some years past for summer houses, and which has been taken up by many of the railroads as the most proper color for their passenger cars.

One who has a house to paint, however, and is without especial experience in the matter of combining shades to produce pleasing effects, may very easily err in endeavoring to obtain the results desired with these or with other colors, unless a professional decorator or expert be called in, or the required information can be had from some acknowledged authority in such matters, Perhaps one of the most effective, as it has certainly been one of the simplest, means ever devised for disseminating useful ideas in this particular, and helping to develop a proper popular conception of the most pleasing and harmonious combinations of colors for house painting, was hit upon last spring by the old New York paint and color house of Chas. M. Childs & Co., of No. 225 Pearl Street. In their issue of the season's specimen card of their paints, the firm employed an artistic decorator of wide reputation, and presented styles of the best and latest colors in combinations of three each, each combination suggesting the body, trimming, and blinds of a house. Nine combinations were thus presented, from which any one having a house to paint might select with the assurance that, in the judgment of a professional decorator, the most attractive results would be obtained.

We are informed that this plan of exhibiting colors has proved a remarkable success, and that people in all sections of the country have availed themselves of the suggestions thus afforded, with a degree of satisfaction it would not be possible otherwise to obtain, without incurring the additional expense of employing a professional decorator, which, when called from a large city, is very expensive. The firm have, therefore, just issued a yet more elaborate and artistic card of colors for the present season, embracing twelve different combinations, in which the combinations are made by an experienced decorator, some of the effects presented being exceedingly tasteful. Those who use the combinations of colors here presented may be sure that they will avoid the inharmonious and gaudy effects so often the result of a want of taste or the giving of too little attention to the selection of colors which will "go well together." It really costs no more to paint a house so that it will look neat and attractive than it costs to paint it so it will be an eyesore to everybody, and the card presented by the Messrs. Childs affords an easy way whereby the most inexperienced can obtain the one end and avoid the other.

The firm has been established since 1851, and during its long business experience has made a solid reputation for thorough trustworthiness in its representations of paints. This is a point in regard to which buyers generally cannot be too particular, for there are few of them comparatively who have the means or the expert ability to make a scientific analysis of the composition of paints, and it is of the utmost importance, therefore, that they should buy of thoroughly reliable houses. A very poor paint will often look tolerably well when first put on, but it soon begins to present a weather-beaten and rusty appearance, in great contrast with that afforded by a good paint properly put on. Good paint is always the cheapest in the end, and when it is to be had ready mixed, the best pigments thoroughly ground and mixed with the best vehicles, it is a very shortsighted policy for any builder or owner to use any other article. The greatest care and skill are exercised in the preparation of the paints offered by this house, and they are guaranteed to be equal in all respects to any manufactured. They are put up in packages of various sizes, from a barrel of fifty gallons down to as small a quantity as one quart, and also in cans containing from one to ten pounds.

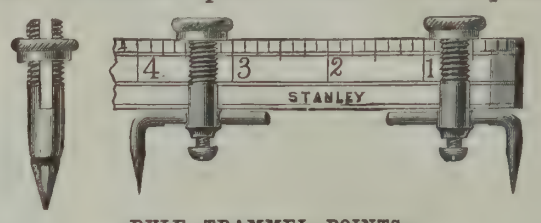
The firm also prepare white paint for inside and outside work, and will at all times make any shade desired, when ordered in quantities of five gallons or over. This is an important consideration, and one that will be well received by builders, since it practically places at their disposal all the skill, experience, material, and machinery of an extensive paint works, and enables them to experiment with new colors at a moderate expense, and to order new shades of their own selection, with the certainty that their instructions will be faithfully followed.

It would be well for those contemplating building or painting this spring to send for one of these cards, even if for no other purpose than to have specimens of the shades that will be widely used. Further information concerning these paints, prices, etc., may be obtained by addressing Messrs. Childs & Co., as above.

AUXILIARY TOOLS.

We represent on this page two specimens of tools which can properly be designated as auxiliary tools, in that they have their chief value when attached to other standard tools, always found in the possession of carpenters; and if so attached, they give to such other tools new and important additional uses.

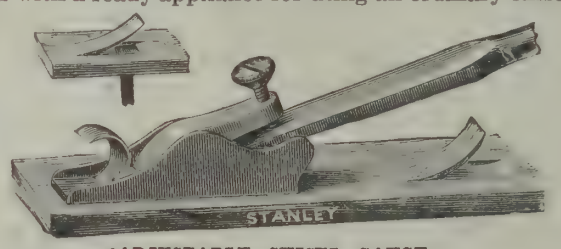
The rule trammel points consist of three pieces,



RULE TRAMMEL POINTS.

two having movable steel points, while the third contains a socket for a pencil. These can all be used on common folding rules of any width, and may be adjusted for scribing with the end of the rule, for making parallel lines, or for striking circles of any diameter.

The adjustable chisel gauge furnishes wood-workers with a ready appliance for using an ordinary chisel



ADJUSTABLE CHISEL GAUGE.

in turning up a shaving with precision where blind nailing is required. After the nail or screw is driven, the shaving can be glued down again for finishing purposes. The Stanley Rule and Level Company, New Britain, Conn., manufacture, and hardware dealers sell, these tools.

ART METAL WORK.

This cut illustrates one of the many styles of door grilles now being made by the Joseph Neumann Co. (limited), northwest corner Eleventh and Race Streets, Philadelphia, Pa.

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desired) while the door is fastened, being fitted with plate glass, arranged to open and close.

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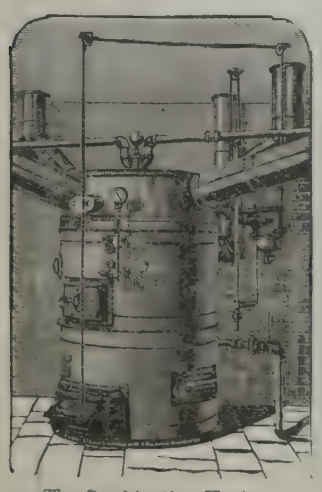

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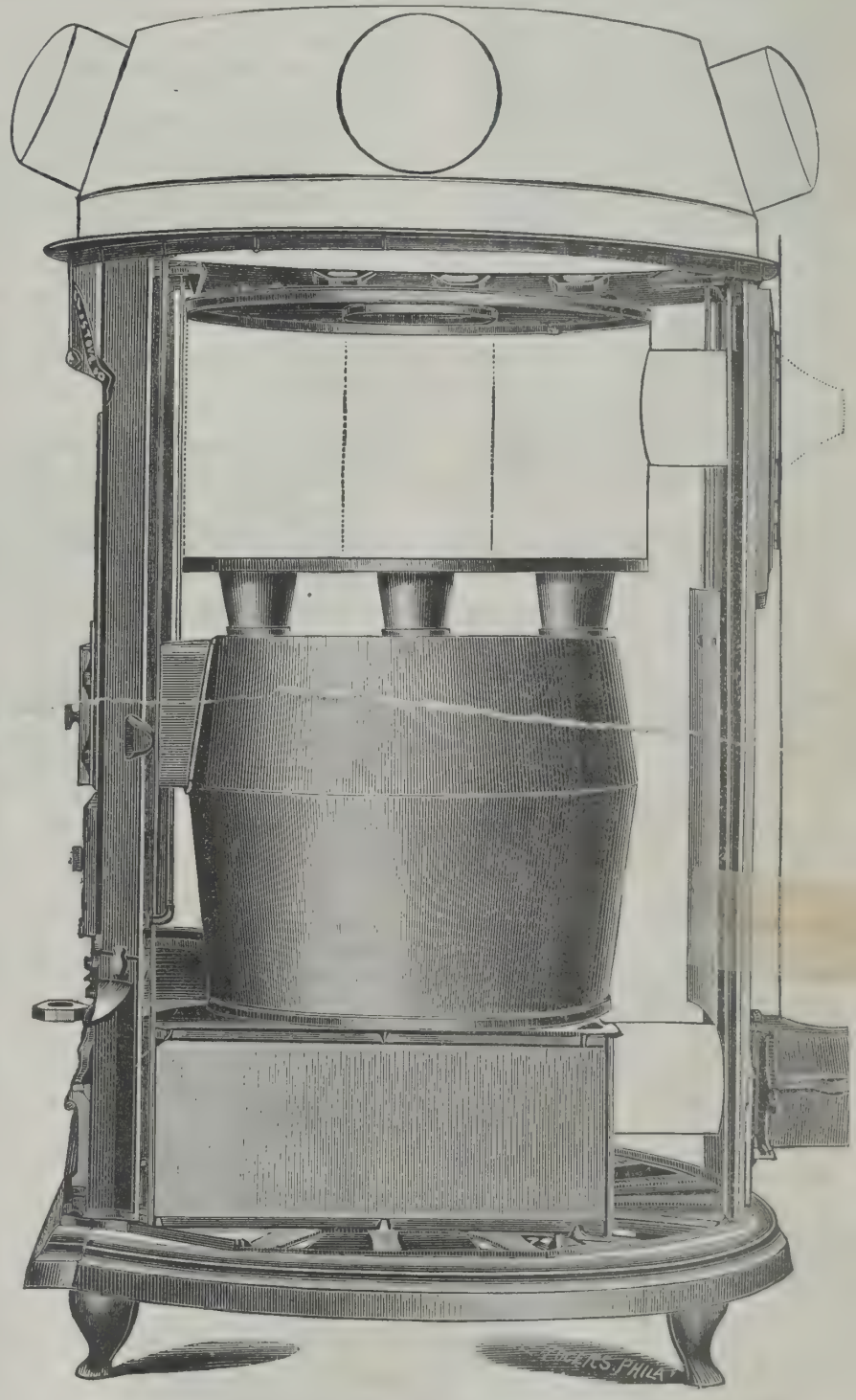

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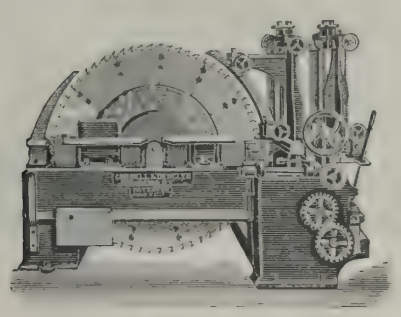

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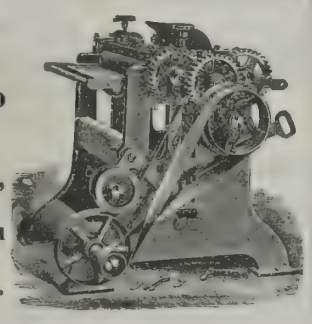

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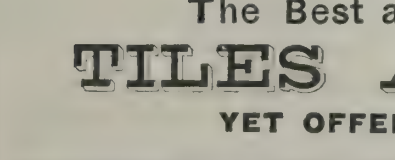

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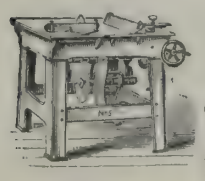

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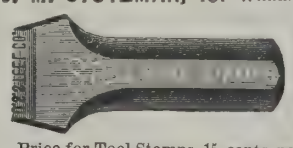

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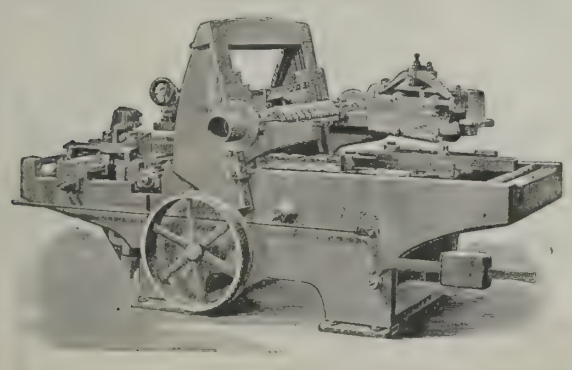

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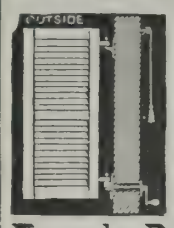

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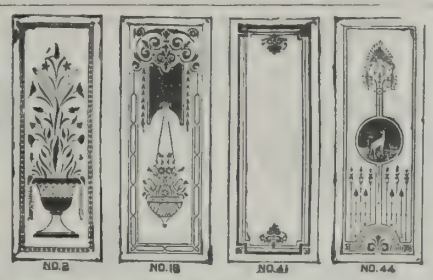

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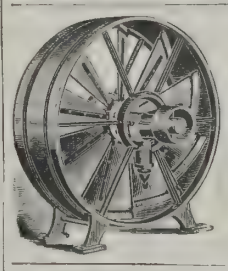

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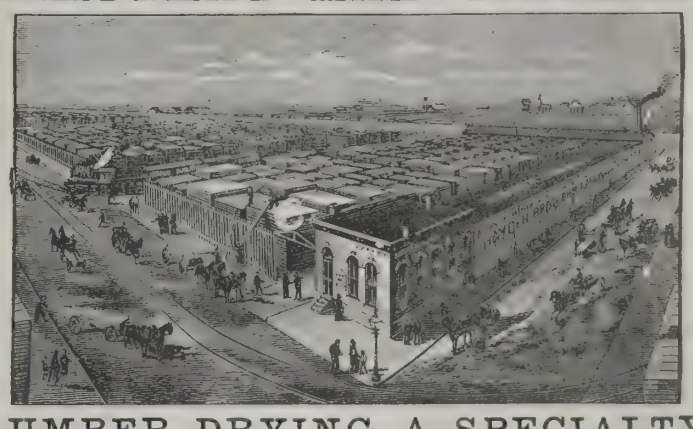

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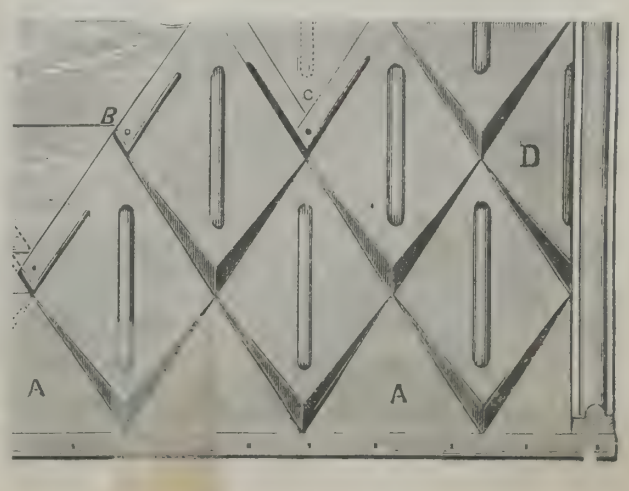

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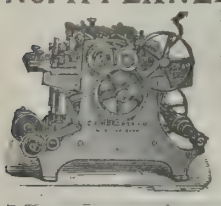

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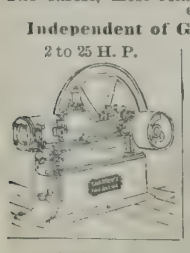

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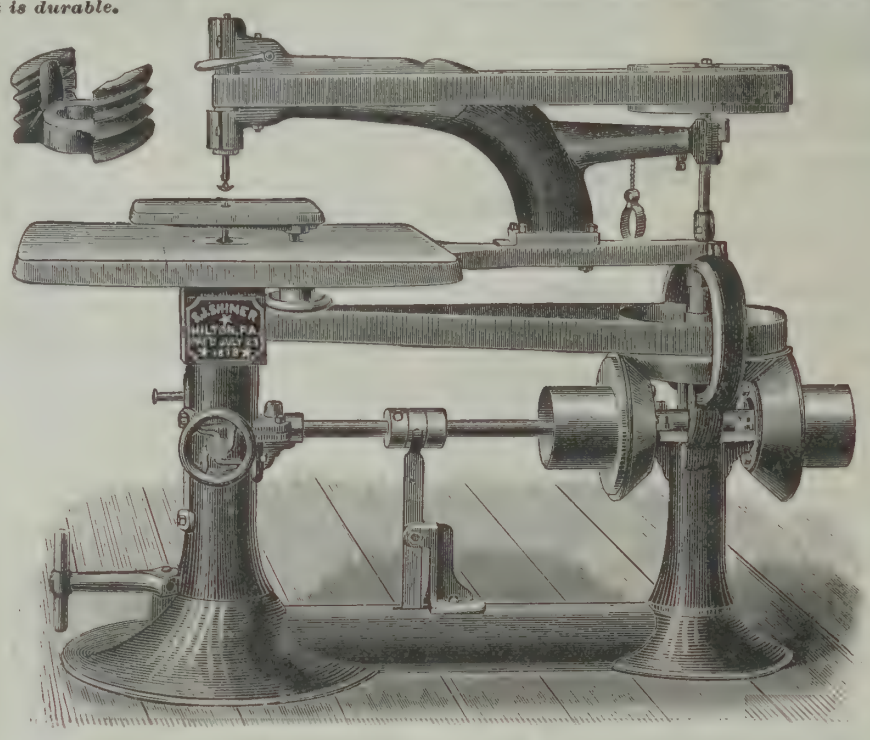
You never tire of the make up of this Machine, which is as simple and effective as it is durable.



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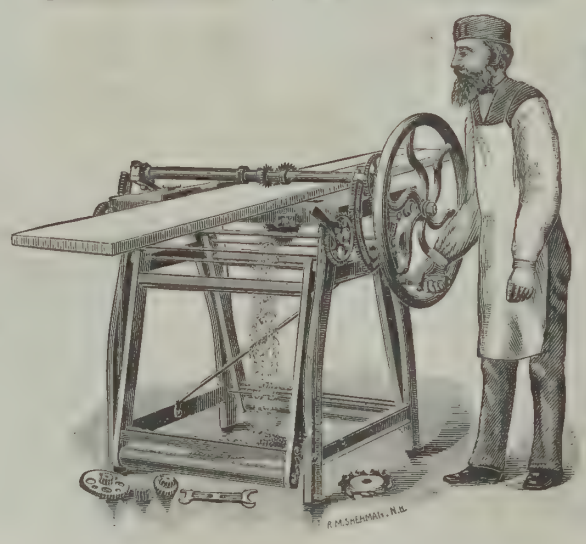

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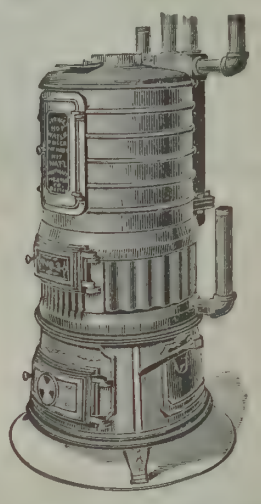

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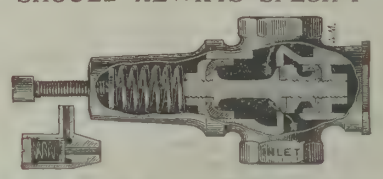

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
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(1) R. S. S. H. asks: What can be done to renovate and brighten the gilt frames of pictures and mirrors that have become rusty and dingy? A. You may improve them by simply washing them with a small sponge moistened with spirits of wine or oil of turpentine, the sponge only to be sufficiently wet to take off the dirt and fly marks. They should not be wiped afterward, but left to dry of themselves.

(2) H. C. D. writes: Can you give me a recipe for a laundry marking ink which will not wash or bleach out in the ordinary way of washing, and will flow freely from the pen, and will not need any preparation for setting it in either heat or chemical, but will be indelible from the minute it is put on the goods? A. Dissolve, with the assistance of heat, 20 parts of brown shellac in a solution of 30 parts of borax in 300 to 400 parts of water, and filter the solution while hot. Then add to the filtrate a solution of 10 parts of aniline black soluble in water, three tenths parts of tannin, one-tenth part of picric acid, 15 parts of spirit of sal ammoniac, and one-quarter ounce of water. To purify water see the "Purification of Drinking Water by Alum," contained in Scientific American Supplement, No. 491.

(3) L. P. asks (1) how prepared gypsum for calcimining and whitening is manufactured. What is the best and cheapest way to pulverize the gypsum for making plaster of Paris, also the best way for calcining it? A. It is ground between burr stones until it is reduced to a fine powder. This is calcined by being heated in kettles or stills, the escaping water producing a movement like ebullition. 2. How can I test lime rock to tell whether it will make hydraulic lime or not? A. By testing for silica. To be a good hydraulic cement, it must contain at least 10 per cent of silica. A. 3. What is red pipe clay good for? Will it make paint if ground fine? A. Any colored oxide mixed with linseed oil can be used as a paint, but if it requires too much oil, then it is practically valueless. Pipe clay can be used for the cheaper grades of pottery.

(4) F. B. desires a good receipt for stopping a crack or small hole in a large sink. A. Take of litharge 20 parts and 1 of burnt lime in fine, dry powder. Make into a putty with linseed oil.

(5) T. H. writes: I want to fill a cistern with a force pump, a distance or height of nineteen feet. Which will require most pressure—to fill from the bottom or top of cistern, and what is the difference? A. It takes a trifle less power to fill at the bottom, the difference in pressure per square inch being equal to forty-three one-hundredths of a pound for each foot of distance between the surface of the water in the tank and the filling spout at the top of the tank.

(6) S. asks how window glass is measured in the box. A. A box of window glass contains 50 square feet of glass, without regard to size.

(*Continued on page* x.)

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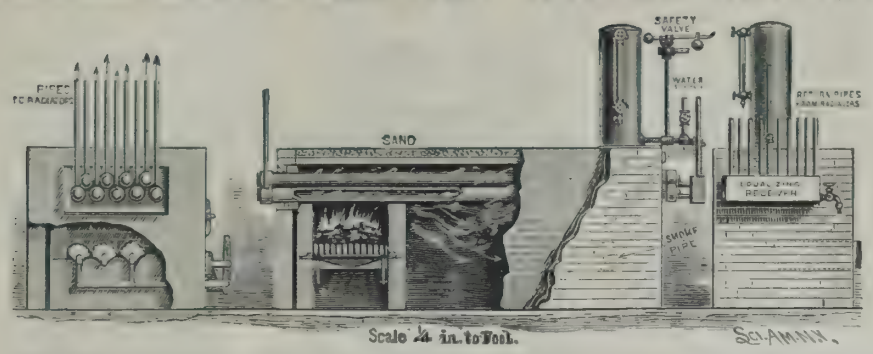

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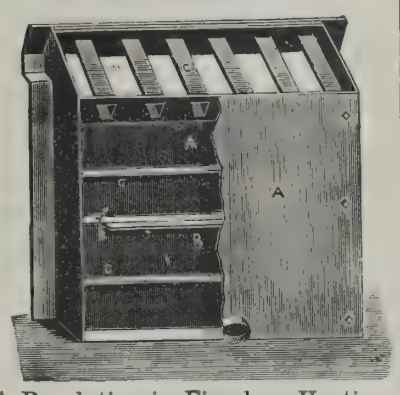

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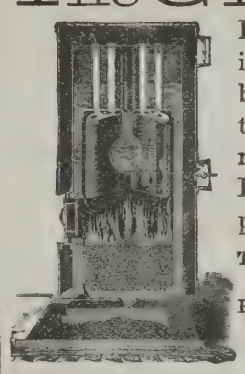

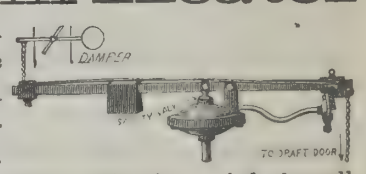

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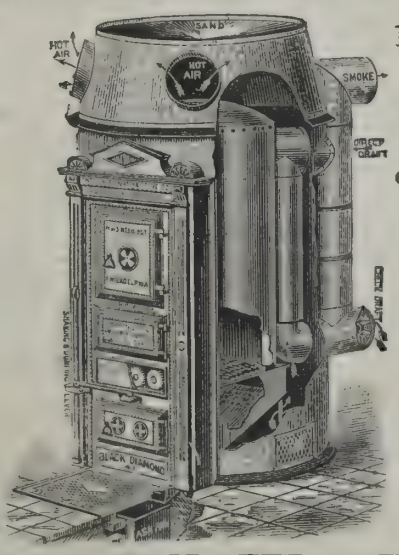

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(*Continued from page* vi.)

(7) J. B. C.—Lead does not run smooth in casting with any kind of mould, nor do we know of any elastic substance that will not be destroyed by the heat of melted lead. If you can alloy the lead with tin or with tin and bismuth, it will run smooth at much lower temperature than the melting point of lead. Old type make a smooth-running metal, which can be cast in plaster of Paris moulds.

(8) F. H.—Marble is finished by grinding the surface with fine sand under a slab of stone, which may be a piece of marble or sandstone, to a true surface. Then the surface is smoothed with ground pumice stone under a rubber of leather or felt, and afterward polished with oxide of tin and water with a rubber of felt. The rubber is fastened to a block of wood.

(9) B. A. asks for directions for making the composition for self-inking pad for rubber stamps. A. the usual composition consists of 2 to 4 drachms aniline, of desired shade, 15 ounces alcohol, and 15 ounces glycerine. The solution is poured on the cushion and rubbed in with a brush. Another formula includes 1 part gelatine, 1 part water, 6 parts glycerine, and sufficient coloring matter.

(10) W. A. P. asks the cheapest, simplest, and most practical way for an amateur to make a furnace to melt from 5 to 10 pounds of brass for casting. A. You can easily melt 5 to 10 pounds of brass in a blacksmith's forge. Use a blacklead crucible of the proper size. Build a fire chamber around the tuyere 2½ times the diameter of the crucible, with fire brick, or common brick if you have no fire brick. Use no mortar. Bank around the outside with forge ashes or cinder. Set the crucible 4 or 5 inches above the tuyere on the fire and fill in all round, and cover with a large piece of charcoal. Put in the metal after the fire is started. Keep the crucible lifted to its proper place as the fire settles. Do not blow too hard, nor heat the metal so hot as to boil it, which makes it spongy. Use a little powdered charcoal on the surface of the metal while melting, to keep it from oxidizing. Blow the charcoal off with a hand bellows when ready to pour.

(11) J. H. D. asks for a receipt to remove paint from a wood carving without damaging the wood, as burning or scraping would ruin it. A. Mix 1 part by weight of pearlash with 3 parts quick stone lime by slaking the lime in water and then adding the pearlash, making the mixture about the consistence of paint Lay the above over the whole of the work required to be cleaned, with an old brush; let it remain 14 or 16 hours, when the paint can easily be scraped off.

(12) A. L. J. asks: 1. What will take rust from finely polished steel, such as drawing instruments, etc., without scratching them? A. Mix 10 parts of tin putty, 8 of prepared buck's horn, and 25 of alcohol to a paste. Cleanse the article with this, and finally rub with soft blotting paper. 2. What will prevent their rusting? A. You can preserve them by a coat of colorless lacquer. 3. How to clean gun barrels of rust and keep them so? A. The gun can be cleaned by stopping the opening and pouring in mercury, which, on shaking, will clean up the barrel. Then coat with paraffine. 4. A good cement for leather for patching shoes? A. Make a rubber cement. See Scientific American Supplement, No. 158, under "Cements."

(13) L. P. McC. asks: 1. Is there anything I can apply to the cement coating in my cistern to harden it, or render it so that it will not make the rain water hard? A. Probably your cistern is coated with a poor quality of cement, which is partially soluble in water. There is nothing better than a lining of pure Portland cement. Clean and scrape the walls and bottom of the cistern, and plaster with a thin coat of pure Portland cement. 2. What is the number of asteroids now discovered? A. There are over 260 asteroids known. We have not the complete list to the present time.

(14) E. H. S. & Sons ask how glass is silvered. A. For this purpose a large, perfectly flat stone table is provided. Upon it is evenly spread a sheet of tin foil without a crack or flaw. This is covered uniformly to the depth of ⅛ inch with clean mercury. The plate of glass, perfectly cleansed from all grease and impurity, is floated on to the mercury carefully, so as to exclude all air bubbles. It is then pressed down by loading it with weights, in order to press out all the mercury which remains fluid, which is then received in a gutter around the stone. After about twenty hours it is raised gently on its edge, and in a few weeks it is ready to frame.

(15) C. H. P. writes: I have a well, distant about 300 feet from a stream of water. The bottom of the well is about 10 feet deeper than the stream; the well is used to supply a 15 horse power boiler, but the supply is insufficient. Can I siphon water from the stream? If so, how? A. Provided that you do not have to make the apex of the siphon more than 28 feet above the stream, you can lay the pipe, protected from freezing, from the stream to the highest point. There insert a tee, and continue the pipe to below the surface of the water in the well. Connect the outlet of the tee with the pump. If convenient, place a valve each side of the tee in the main pipe, to control the direction of the supply. Make all air tight, open the valves and pump the air out, when the water from the stream will flow to both pump and well. The pump will always keep the siphon free from air. Use the same size pipe as now used for the well connection.

(16) G. T. M., Jr., of Nyack, wishes to know if it is feasible to put down a driven well through a stratum of quicksand to a bed of gravel. The building in which it is desired to put the well is three stories high in addition to the basement, and foundation walls are 18 inches in thickness. A. The well can be driven in the cellar if there is head room enough to swing a heavy maul with which the pipe must be driven. The method of driving a well that is not to be put down over thirty feet is to screw a heavy cap on top of the pipe, place a block of wood on top of the cap and strike the block with the maul. The wood is used to receive the shock of the blow, so as not to shatter the cap or the pipe. The lower end of the pipe is shod with a chisel shaped bar that penetrates dense soil or loose rock with ease. The drive pipes come in 5 ft. lengths.

(17) C. F., of Milwaukee, Wis., has a large factory which exhibits a decided tendency to vibration in the upper stories, and the cause has been ascribed to the running of heavy cars about 80 ft. in front of the building and to the operation of heavy machinery in its rear. The foundation is on piles in marshy ground. The swaying of the building has not yet produced any cracks or openings in the masonry. Until it does so, we should have no fear for the safety of the building, because there is a certain amount of elasticity in a wall of masonry, and as long as that limit is not exceeded, the wall's equilibrium will be maintained, even under shocks severe enough to produce oscillations. We think, however, the amount of movement mentioned by our correspondent is overestimated, and we would be pleased to hear how it was measured. There are several methods that have been tried to overcome this vibration in buildings intended for the operation of heavy machinery, but, to be successful, they must be adopted when the foundations are begun.

(18) F. L. F., of Kansas City, would like to learn the cost of a fireproof floor 28 by 31, on the Hennebique system, and some of the details of construction. A. The following bill of quantities and estimate of cost will throw some light on the subject:

One 15 inch light I beam 29 ft., 50 lb. per ft., 1,450 lb., at 4c. per lb.	$58.00
4 cast iron coupling plates, ½ in. × 6 in. × 28 ft., 280 lb., at 3c.	8.40
36 pairs iron rods, 9 in. C C, 1 in. diam., 2,733 lb., at 3c.	81.99
324 coupling plates, ¼ in. × 2 in. × 6 in., 270 lb., at 3c.	10.80
Labor of placing and setting, 1c. per lb., 4,733 lb.	47.33
16 cubic yards concrete fireproofing at $5 per yard	80.00
Total	$286.52

Load is estimated at 100 lb. per square foot, including the weight of the concrete. The girder is calculated to sustain one-half the total load. Has a bearing of six inches at each end, and is supported by wall plates ½ in. × 8 in. × 2 ft. The iron rods opposite the girder are supported on a cast iron plate, drilled with one and one thirty-second inch diameter holes to receive them. The coupling plates must fit snugly upon the rods in order to insure transmission of the strain upon the upper rod to the lower rod, and to prevent lateral movement independently of one another. In other words, the horizontal thrust must be borne by the two as a unit. We have no data upon which to calculate the shearing strain of the concrete, and must provide for the shearing force which is taken care of by the coupling plates. The fireproofing may be composed of the following materials: 5 parts of plaster of Paris, 20 parts of locomotive cinders, 25 parts of refuse wall plaster, and 50 parts of hydraulic lime, preferably lime of Teil. It will weight about 52 lb. per square foot.

(19) W. O. says: Will you kindly oblige one who, although a helpless invalid for fifteen years, is still much interested in your paper, by giving him the best information at your disposal? 1. What is the composition and process of manufacture of the best artificial stone sidewalk you know of? A. To make a cement walk, level the ground and pack the earth well; then spread upon it a stiff mortar three inches thick, of sharp sand four parts, best cement one part. Cover this while fresh with another coating of mortar made of best Portland cement one part, clean, sharp sand 2 parts. 2. Is there a reliable artificial building stone? If so, what is it composed of? A. Good artificial stone is made of best Portland cement one part, clean, sharp sand two parts, mixed stiff, shaped in boxes to give the desired form of blocks.

Classified Index of Advertisements Published in the Present Number of the Scientific American, Architects and Builders Edition.

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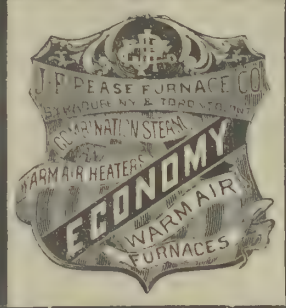

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Resembling Wood or Coal.

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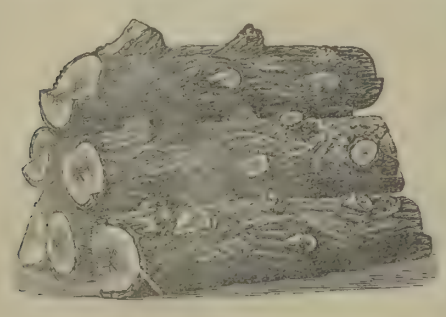

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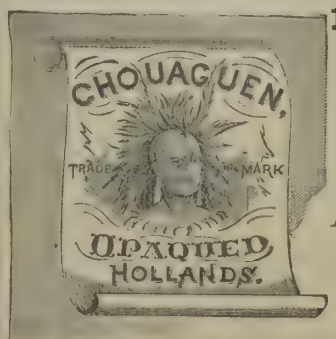

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G.A.AVERY.SC

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PLUMBERS' GAS ENGINE.

Especially adapted for pumping water in Private and Apartment Houses, Flats, Small Hotels, and many other places.

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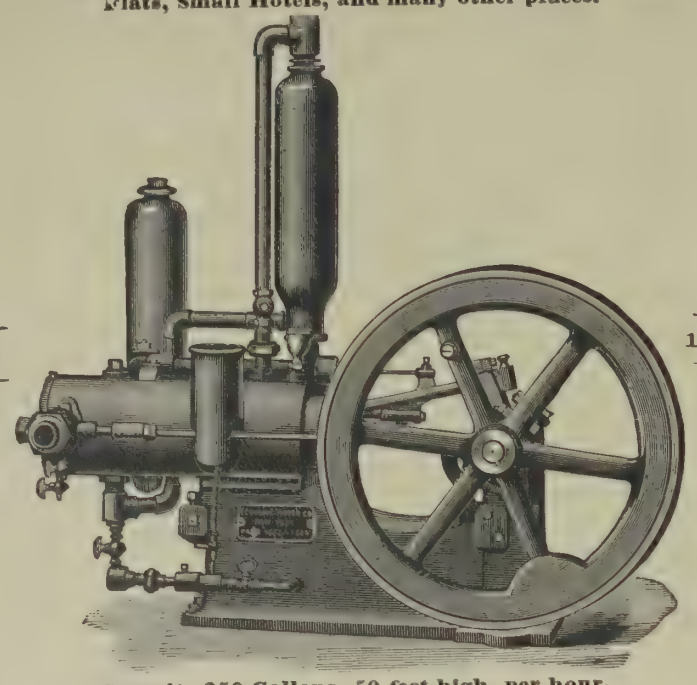

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Our Gas Engines will work satisfactorily when attached to Gasoline Machines.

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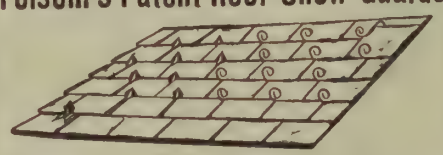

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The **"SAMSON"** Window Line does not wear out. Save the annoyance of broken cords. Samples free on application to the manufacturers.
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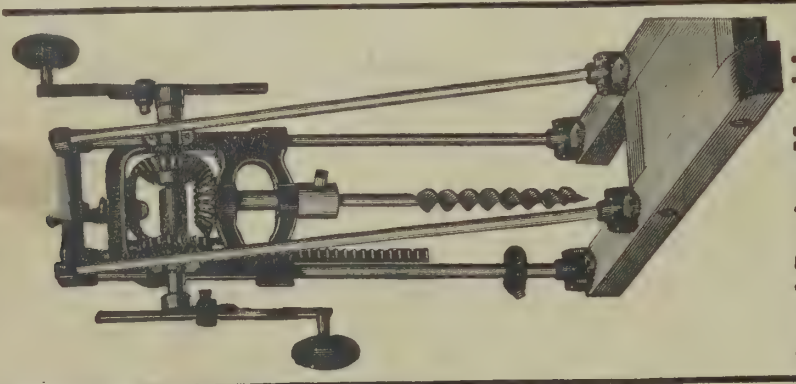

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We guarantee one square foot of heating surface per horse power.

We can give reference from Heaters already in operation under the same conditions, giving the best of satisfaction.

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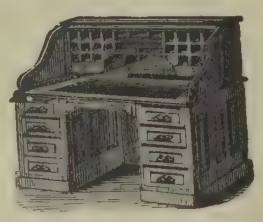

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PRICE.
No. 45. Iron Stock and Fence, $8.00

A Southern Carpenter writes concerning this tool: "A first-class Mechanic's pet. *Worth its weight in silver.*"

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Entered at the Post Office of New York as Second Class Matter.

ARCHITECTS AND BUILDERS EDITION.

Vol. V. Subscription, $2.50 a Year. NEW YORK, MARCH, 1888. Single Copies, 25 Cents. No. 3.

DESIGN FOR A HALL AND STAIRWAY.

We give a sketch of the hall and stairway of a luxurious English dwelling, Wadhurst, South Park, England, which we find in *La Semaine des Constructeurs.* Gillow & Co., architects. Richness of decoration, numberless objects of art, pictures, statues, Chinese porcelain, ceilings of embossed leather panels, tapestry carpets in single piece, covering floor and stairway, electric lights—all unite in securing that air of comfort to obtain which the English use the resources, art, and the facilities offered by the most recent progressive forms of industry.

Ancient Water Works.

Among the great water works of the world, those of Peru were in some respects the most difficult achievements of any. The Incas built aqueducts from the slopes of the Andes for a distance of more than 100 miles to the capital; carrying the water partly through tunnels cut in the rocks, and partly on arcades on supporting pillars of mason work to span valleys—the channels being composed of cut stone without cement. From these great aqueducts a number of branch conduits and furrows were laid laterally for irrigation purposes. The ancient water works at Jerusalem consisted first of wells in the limestone ridges on which the city was built; but as the population increased, the Jews were obliged to gather the rainfall during the winter season, and store it in tanks and cisterns placed in secure inclosures and within the walls of the temple. An aqueduct constructed of stone laid in cement, brings water from the pools of Bethlehem, about six miles, to a tank lying under the chief Turkish mosque. The population of Jerusalem seldom suffered from water famine. Strabo mentions as something remarkable that there was always a plentiful supply of water within the city while a famine prevailed in the region around about. The water works of Athens were begun about 560 B. C., and consisted of stone aqueducts lined with baked clay, and carried almost wholly on the surface of the ground. Carthage was supplied by water brought from the hill ranges on the south, upward of 70 miles distant; and the ruins of an aqueduct, built in the Roman style, may still be seen.

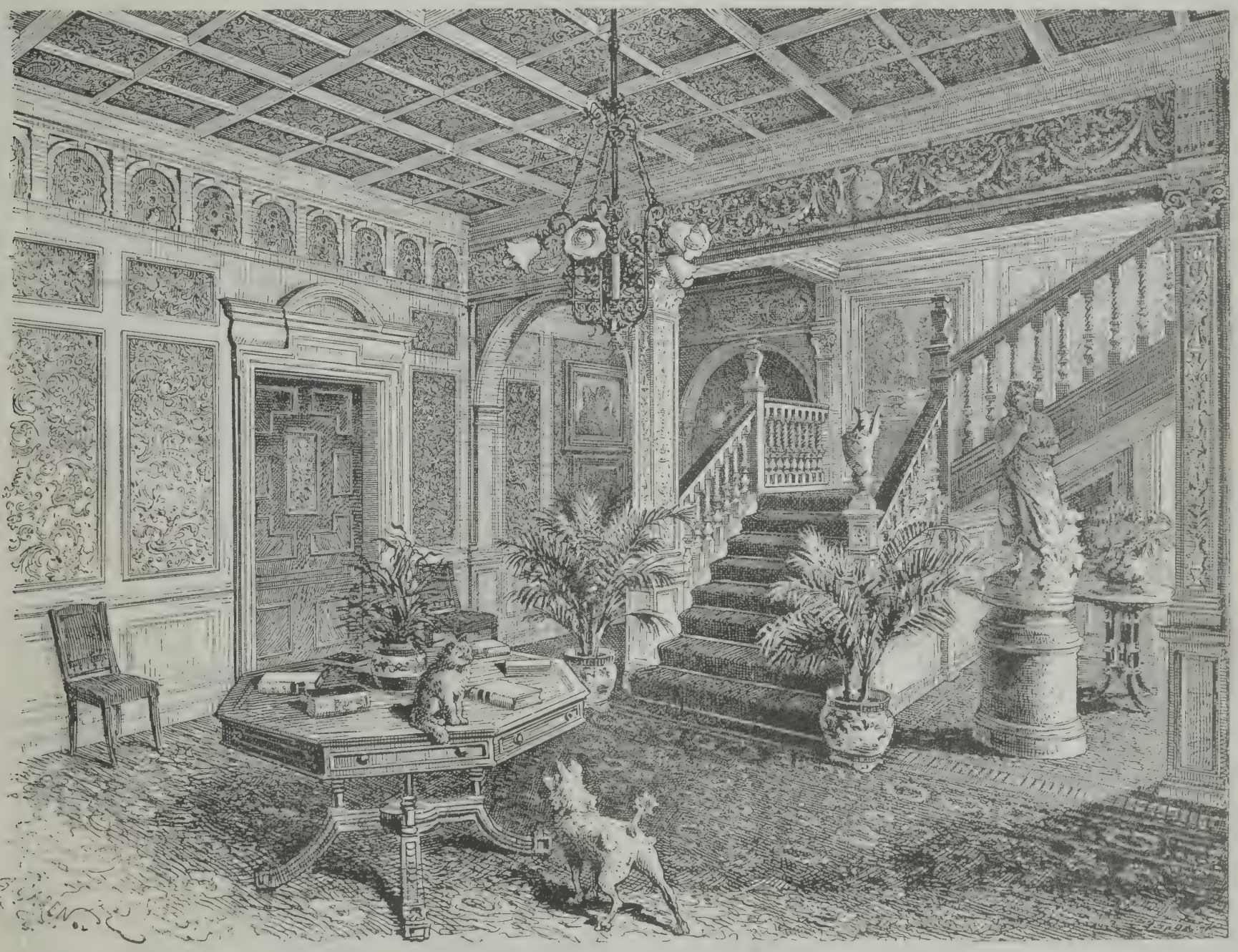
Making the House Water Tight.

We continue our remarks from the January number concerning the importance of constructing houses so that they will be *water tight.*

Nothing will conduce more to this than to flash with strips of tin all the corner boards, door and window frames, where the ends of the outer covering (such as clapboards or novelty siding) come in contact with them.

This plan is a novel one and seldom, if ever, adopted. It is not expensive, but if it were, it would repay all the cost in the permanent benefit to the building. The writer has used it to his great satisfaction, and would not omit it from any future specifications.

The strips are of tin, about 2½" wide, and cut from sheets 20 × 28. These are placed perpendicularly against the sheathing edge, so that the edge not under the clapboard will lap about ⅜ of an inch over the corner board, door or window frame, as the case may be. The outer covering follows these strips upward. The overlap should be hammered down flat, so as to make a good finish, and in some cases a few tacks may be needed to make a smooth job. If this work is well done, the usual shrinkage of the wood does not open to the weather the sheathing and plastering of the house. These openings may be seen in almost any new house shortly after it has been built, and through them the rain enters, staining and damaging the plastering, paper, or decorations within. The usual remedy is putty or white lead. This, however, is only temporary, for they each crack and fall out after a short time, so that the operation must be often repeated. Window frames are frequently so constructed that the water can get in on the sides or in the corners at the bottom. The former trouble may be remedied by caulking with oakum and then filling with putty or white lead; the latter, by a strip of very thin copper nailed down carefully.



DESIGN FOR A HALL AND STAIRWAY.

This is the season of the year for the tin gutters and leaders to be injured by the ice and snow. The snow falls upon the roof and accumulates in the valleys and gutters. The temperature rises enough to partially melt the snow, and at nightfall again lowers to or below the freezing point, and the result is that the gutters and valleys are filled with solid ice. The sudden expansion of the freezing water bursts open the joints of the tin, and leaks are quickly made. As proof of this observe during a thaw the pendent icicles from the cornices of many houses, coming, not from the flow *over* the gutters, but through openings *in it.* Mark carefully these places now, and in early spring make the repairs without delay. Decay of the woodwork speedily follows neglect of these precautions, and expense of repairs increased tenfold.

WOOL saturated with a 10 per cent. solution of glycerine can bear exposure to 130° to 140° without injury.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

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O. D. MUNN. A. E. BEACH.

NEW YORK, MARCH, 1888.

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MUNN & Co., Publishers, 361 Broadway, New York.

CONTENTS

Of the March number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

A COTTAGE OF MODERATE COST.

One of our plates in colors shows a cottage designed by J. Averit Webster, architect, No. 110 E. 125th Street, New York City. Presenting as it does from every direction good sky lines as well as distinctive features in chimneys, dormers, etc., it is deserving of a good sized plat of land where the view from all sides is as little obstructed as possible. The verandas are so situated that one of them will always be in the shade in the hot summer days, and none of them is so wide or low as to shut the light away from the adjoining rooms.

Planned as it has been for a home, where every room will be used daily, hall, parlor, and dining room have been separated only by *portieres*. Sliding doors could be placed between parlor and dining room, and the staircase leading from dining room inclosed. But to do the latter would sacrifice one of the most attractive features of the house. The platform where the two staircases meet, with its colored glass window and broad seat, will be found a pleasant lounging place. The rooms are all of goodly size, and so arranged that there are places to put the furniture without interfering with windows or doors—a point in house planning that is frequently lost sight of. The sitting room can be used as a sleeping room if desired.

This house can be built in the vicinity of New York, in a thoroughly good manner, as specified, at a total cost of not more than $3,500.

SPECIFICATIONS.

This specification is intended to supplement the drawings, and specify and explain only such details of construction, quality of material, etc., as cannot there be clearly shown.

All materials, unless expressly stated otherwise, must be of the very best of their respective kinds, and be promptly furnished before needed, to the end that no delay in the progress of the work may occur from want of material at any time.

Each contractor must perform his work at the proper time and with all reasonable promptness, so that no other class of workmen shall be delayed by him.

First-class workmanship will be expected and required in every particular.

MASON.

Under this head is included all excavating, grading, all stone and brick work, all plastering, together with all the necessary materials for the same. Also cistern and drains.

Excavating.—Excavate for cellar and foundation walls as shown by plans and sections. Put aside the earth removed, to be used in grading after house is completed. No foundation shall be less than two feet below the surface of the ground when grading is completed.

Drains.—Lay all earthenware drains as shown on cellar plans. Tile must be laid with tight joints on a solid foundation, in a straight line, with a uniform fall of not less than ¼ inch to the foot, and the top of the drain at its highest point at least four inches below the bottom of foundation walls.

Stone Walls.—Footing course to consist of large, flat stone, well bedded and laid edge to edge. Build walls of good building stone, straight and plumb, and well bonded. Inside of cellar wall to be neatly pointed. All stone walls to be coated on outside with asphaltum. Mortar for all stone work, and also for all brick work below sills of house, to be composed of five parts of clean, sharp sand and two parts of Rosendale cement. No tempered-up mortar to be used.

Cellar Bottom.—Make foundation by firmly ramming down coarse gravel four inches in thickness. Upon this put a coat of cement mortar mixed with small gravel or broken stone, two inches thick, well rammed, and finish with a coat of cement one inch thick, which last shall be floated off smooth and level.

Brick Work.—Build foundation walls, chimneys, piers, etc., as shown by drawings. The best and most evenly colored of the brick to be selected for the face of walls and outside work on chimneys. Select the hardest burned brick for the walls near the ground. All outside brick work to be laid in red mortar. Use Peerless color, manufactured by Saml. French & Co., Philadelphia. Bond the foundation walls every sixth course, by clipping outside bricks and laying in diagonal headers. Mortar for brick work shall consist of one part of good Rockland lime and three parts clean, sharp sand. The lime must be thoroughly slaked and mortar well mixed before using. All outside work to be washed down with acid and oiled.

Chimneys.—Build up as shown by plans, elevations, and details. Smoke flues to have joints struck smooth. Build in tin hot air pipes where shown. Turn trimmer arches at all fireplaces. Furnish and set all terra cotta and stone shown in chimney stacks. Chimney caps to be of bluestone. Supply iron braces as shown.

When frame is up carry up brick walls to top of beams, and fill in between all studs of outside walls to top of base board.

Lathing and Plastering.—Use No. 1 St. John spruce lath. Openings between laths must not be less than $\frac{5}{16}$ of an inch, and joints must be broken every 18".*

* If any walls or ceilings are found not to be straight and true, the mason will call on the carpenter to make them so before putting on lath.

Inside of brick foundation walls to be furred and lathed and plastered two coats. Cellar ceiling to be lathed and plastered two coats. All walls and ceilings of first and second stories to be plastered three coats.

The scratch coat shall consist of two parts of No. 1 Rockland lime and five parts of clean, sharp sand, with plenty of long hair. The lime to be thoroughly slaked before sand and hair are put in. Hair to be well beaten and soaked before mixing in mortar. All mortar must stand at least one week after mixing before it is used.

Browning coat same as scratch coat, except hair. Keep well up to grounds and down to floors. Float and level off so that all walls, ceilings, and angles are straight, true, level, and plumb. Finishing coat to consist of No. 1 lump finishing lime, clean white sand, and plaster of Paris in proper proportions. Lime to be slaked and strained, and allowed ten days to season before using. Hard finish all walls and ceilings except in cellar. Run mouldings in hall, parlor, dining and sitting rooms, and chambers, as shown by details. Put up plaster arches and brackets where shown. In parlor put up plaster center, to cost $2.50; in hall and dining room to cost $1.50 each. Patch up after all other workmen, and leave work in perfect order. After white coat is on, clean out all waste and cart away from premises.

Grade grounds after all other work is finished.

CARPENTER'S SPECIFICATION.

The carpenter will furnish all the materials and do all work necessary to complete the house, excepting as heretofore specified in mason's specification, and items named hereafter to be furnished by the owner.

All lumber and timber must be of good quality and entirely free from shakes, rot, and large knots. Finishing lumber must show clear when up and be thoroughly kiln dried.

Framing.—Details show sizes of timbers and methods of framing, sills, beams, rafters, and all outside studs of spruce. Partition studs of hemlock 2×4. All studs and beams 16" centers. Rafters may be 20" centers. Double studs at sides of all doors and windows. Corner posts 4×6." Sides and roof of entire building to be sheathed with ⅞ pine boards dressed on one side. All sheathing to be covered with heavy good quality resin sized sheathing paper, joints lapped and tacked. Paper must extend behind all windows and door casings, corner boards, cornice, etc. Weatherboards dry, beveled white pine, 6" wide, laid 4½" to the weather. Shingles cedar, 18" long, 6" wide, clear, dry, and of first quality. On sides butts cut as shown by details. Square butts on roof. Shingles on roof may be laid 5" to weather, and on sides 6".

Corner boards and hanging stiles 1⅛" thick. Water table, window caps, cornice, brackets, etc., as shown by details.

All lumber used in outside work of house must be white pine, extra dry, free from sap, shakes, rot, or large, loose, or black knots.

Tin and Galvanized Iron Work.—Roof o rear veranda to be tinned with 14×20" IX bright charcoal roofing plates. Same quality of tin to be used for valleys and flashing. Under each course of shingles on hips lay 7×10 tin plate. Flash well over all windows, doors, etc., and around chimneys, and at all points where a roof and side of house join.

All gutters and leaders to be of galvanized iron. Gutters to be constructed as shown by details and set with a fall of at least ⅛" to the foot. Connections to be made so that a part of the water from roof may be discharged either into tank adjoining bath room or into cistern, as may be desired.

Furnish all tin pipes required to convey hot air from furnace.

Cresting to be made of galvanized iron, as per detail.

Gas Fitting.—Run all pipes before floors are laid. Use no pipe smaller than ⅜". Set all side lights 5½' from the floor. Run pipe for chandeliers in hall, parlor, dining room, and sitting room; also, front chamber. Side lights for all other rooms. Two side lights in cellar. Stop cock and meter connections in cellar.

Owner will furnish chandeliers and hall lantern. All ordinary burners to be furnished by gas fitter.

Floors of Georgia pine for first and second stories. Boards not over 4" wide. Spruce flooring over entire attic.

Furnish and set all grounds needed for plastering. Care to be taken to get all plumb, straight, and true.

Set up stairs as soon as brown coat is on. Construction of stairs is shown in details and plans. Cellar stairs of Georgia pine Main stairs of yellow poplar, with cherry newels, hand rail, and balusters.

Trim, etc.—The kitchen and pantry to be trimmed entirely with Georgia pine. All the rest of the first floor to be trimmed with the very best quality of yellow poplar, clear, kiln dried, and free from defects of every description. The second story, except bath room, to be trimmed with good white pine that is thoroughly dry, and such as will show entirely clear when up. Trim bath room in ash. Case up cellar and attic windows with white pine. Build frame work and make and

hang white pine batten doors for outside cellar entrance

Sash, Doors, and Blinds.—Sash of first quality clear kiln dried white pine, glazed with double thick French glass, and hung with weights, except French window opening from sitting room and dormers in bath room and attic, which will be hung with butts. Sash to be primed with white lead before being glazed

All doors opening into hall, parlor, sitting and dining rooms, to be cherry. All other doors of white pine. Doors to be made of thoroughly kiln dried, first clear lumber, put together with mortises and tenons, and well wedged and glued. As soon as hung each door shall be either primed or filled, to prevent absorption of moisture from the plastering.

Outside rolling slat blinds for all windows except dormers in bath room and attic. Same quality of material and workmanship as sash.

In kitchen build, as shown on plan, wash tubs and coal box, and case up sink with wainscoting, entire kitchen to be wainscoted 4' high with 2½ × ½ beaded yellow pine, finished with moulded cap 2½" wide.

Fit up pantry with three tiers of shelves. The lower shelf in front of window to be 2' wide, with drawers beneath to floor. Other shelves 16, 12, and 10" wide. Build flour bin to hold one barrel of flour.

Put up strips for wardrobe hooks.

In all closets put up two wide shelves and wardrobe strips.

Mantels to be of cherry in parlor and dining rooms, to cost $20 each. In second story of marbleized slate, to cost $12 each.

In putting up the frame, sheathing, roofing, shingling, laying floors, and in every detail of the work throughout, the carpenter will be required to nail everything thoroughly, as may be directed by the architect or superintendent.

All joints made in putting up trim must be tight. No putty to be used to close up joints. Sash and doors must all run and swing free and clear, and at the same time fit closely, and all be in good working order when the job is completed.

Hardware.—Trimmings for first floor, except kitchen and pantry, of bronze. Porcelain and japan finish for the remainder of house. Mortise locks, with brass bolts, strikes, and face plates, with steel keys for all doors except in cellar. Front door to have good night latch and three 4½ × 4½ loose pin butts. All other doors 1½" thick, two 4½ × 4½ loose pin butts. 1¼" doors, 4 × 4 loose pin butts. All drawers to have two pulls. Sash to be hung with best iron axle pulleys and braided cotton cord.

PAINTING.

The outside of house to be painted three coats. Roofs to be colored tile red. Cresting, finials, and gutters of a darker shade, approaching brown. Shingles on sides one or two shades darker than roof. Cornices, casings, mouldings, etc., dark olive green. Weather boarding light olive. Doors and blinds an intermediate shade. To brighten the general effect, the carving on brackets, ornaments, etc., may be painted bright red or yellow, and crestings and finials touched with gold, but these colors must be used very sparingly. Sash wine color. Metallic paint may be used for roof and all iron and tin work. The body of all paint for woodwork must be pure white lead mixed with boiled linseed oil.

The woodwork of hall, parlor, dining and sitting rooms will be stained mahogany color and finished with three coats Rosenberg's Elastica finish No. 2, the last coat to be rubbed down with pumice stone and oil. Kitchen and pantry two coats best Zanzibar varnish over one coat shellac, not rubbed. All white pine work to be painted two coats, such shades as owner may select.

PLUMBING.

Soil pipe and house drain of 4" cast iron pipe. Water supply pipes ⅝ AA lead pipe. Waste pipe C, and in no case smaller than 1½". Ventilate all pipes to prevent siphonage. Make all necessary connections to supply fixtures with hot and cold water. Connect house drain with sewer. Soil pipe to be carried up in chimney stack above bath room In kitchen furnish and set up, in complete working order, one range with canopy, one 40 gallon galvanized iron boiler, and one steel sink, size shown on plans. Also make necessary connections to supply wash tubs with hot and cold water.

In closet, opening from sitting room, furnish and set up marble top wash stand, 14" decorated porcelain bowl, nickel plated fixtures. In bath room, marble top wash stand, 15" decorated porcelain bowl, nickel fixtures, 5½' 14 ounce bath tub, patent trap and overflow. Universal water closet, with copper lined cistern, complete. (Plate No. 15.)

Adjoining bath room, as shown on floor plan, put up copper lined tank 2' × 4' × 7' inside measurement. All fixtures to be supplied with water from this tank, which will be arranged to be filled both from the roof and from the cistern pump.

In cellar furnish and set up one return flue portable furnace, with all necessary pipes for hot and cold air, registers, etc.

In kitchen place one electric bell, with button at front door, the connecting wires to be carried along cellar ceiling, and battery placed in cellar.

Hearths in parlor and dining room to be tile, to cost 85 cents per foot. Slate hearths in second story

A SUBURBAN RESIDENCE.

One of our colored plates this month illustrates a pleasing residence, of the following dimensions :

Front, not including piazza, 48' ; side, not including piazza and kitchen, 43' 6" ; store room and back porch, 10' × 16' ; kitchen, 18' × 25' ; lavatory back, 5' 6" × 7' 6". For size of rooms see floor plans. Height of stories : cellar, 7' 6" ; first story, 12' ; second story, 11' ; height of ceiling in attic, 8'.

The estimated cost without mantels and furnace is $12,500. There are open fireplaces in dining room, library, parlor, reception room, hall, and three chambers on second floor. The four fireplaces on first story are in one chimney.

The kitchen is set apart from main house, with porch between. The attic is unfinished ; there could be four nice rooms therein.

SPECIFICATION.

These specifications are intended to embrace all of the labor and materials necessary in the erection and completion of the building in all its parts ; the whole to be comprised within any contract or contracts that may be made for the same.

The entire work is to be constructed and finished in every part in a good, substantial, and workmanlike manner, according to the accompanying drawings and these specifications, to the full extent and meaning of the same, and to the entire satisfaction, approval, and acceptance of the owner.

The following is a list of the drawings which accompany these specifications, and which form part thereof : Front elevation, side elevation, side elevation, rear elevation, plan of cellar, first floor plan, second floor plan, plan of attic, roof plan.

Additions, Drawings, etc.—There is also furnished a complete set of detail or working drawings for exterior and interior work, which, used in connection with the above, show all dimensions in relation to the work which is represented by the detail drawings Where figures are not given, all drawings must be accurately followed and measured according to their scale. All writing and figures are to be considered a portion of these specifications, and must be followed and considered. In every case where figures are shown, they must be used in preference to measurement.

Alterations.—It is also understood that the owner of the building shall have the right to make any alterations, additions, or omissions of work or materials herein specified or shown on the drawings, during the progress of the building, that he may find necessary, and the same shall be acceded to by the contractor or contractors, and carried into effect without in any way violating or vitiating the contract. And the value of all such alterations, additions, or omissions shall be agreed upon in writing between the said owner and the contractor before going into execution, or no allowance will be made for them by either party.

Care of Finished Work.—Particular care must be taken by the contractor of all the finished work, as the building progresses, which work must be covered up and thoroughly protected from injury or defacement during the erection and completion of the building.

Specifications and Drawings.—The drawings and specifications are intended to co-operate, so that if anything is mentioned or expressed in the specifications and not shown upon the plans, or, *vice versa*, if anything is shown upon the plans and not mentioned or expressed in the specifications, the same is to be considered and executed by the contractor or contractors as if it were shown and expressed on both plans and specifications.

Rejection of Materials.—The owner shall have full power, at any time during the progress of the work, to reject any materials that he may deem unsuitable for the purposes for which they are intended, or which are not in strict conformity with the spirit of these specifications. He shall also have the power to cause any unsafe or inferior work to be taken down.

MASON WORK.

Excavations.—The cellar is to be excavated to an average depth of 4'. Cellar under the main house only. Trenches for all exterior foundations to be dug at least 3' 0" deep, and all excavations that are necessary to carry out the plans, such as drains, piers, steps, vault and other foundations to be well and faithfully done. The earth to be filled in and packed against the foundation walls after the mortar is dry, and level with the bottom of the underpinning. Also trench under foundation walls and exterior walls and piers, and all other necessary excavations required.

Drains.—All drain pipe to be of best quality drain tile. These pipes to be properly graded. Make all joints clean and tight with Portland cement. Run a 5" soil pipe from inside of cellar wall to sewer ; 3" drain pipe from all leaders to connect to the soil pipe. Furnish and fit all necessary bends, crooks, etc., to make this piping complete.

Foundations and Stone Work

Footings to be laid under all walls and piers, both stone and brick. All footing courses under stone walls to be of concrete 4" wider each way than the walls resting thereon, and 4" thick.

Foundations.—All footings, piers, foundations, brick and stone walls to be built to correspond with the sizes marked on the plans. The stone used in the foundation under the staircase window to be approved medium size quarry stone, laid up as indicated on the elevation, with strong cement mortar, this stone work to have neatly cut cemented joints. The foundations for porches, piers, steps, and kitchen, etc., to extend 3' 0" deep below the grade line. The foundations to be solid concrete and slightly taper on all sides from bottom up. The brick and stone wall coming against the earth to be well cemented on the outside to the top of the ground.

Brick Work.—All face walls and piers above grade exposed to view to be laid with pressed brick, with vertical and horizontal joints. All to be carefully set and bedded on their broadest faces. All neatly laid in red mortar and cleaned off with aqua fortis after completion. This wall will extend 3' above the finished grade. All the walls not exposed to view, including the interior walls in the cellar and those not seen in the chimneys, to be good, hard burnt brick, which must be laid wet in warm, dry weather, or if laid in damp, freezing weather, the brick must be kept perfectly dry. All the brick to be laid up in the best and most workmanlike manner, with mortar composed of good lime, sharp sand, and cement. All piers and walls to be built as represented by the plans, and of such dimensions as marked thereon. The cellar will be 8' from top of cement bottom to the under side of floor beams.

The chimneys to be built and carried up as represented by the drawings, with pressed brick laid in red mortar. All flues to be struck joints on the inside, and left free and clean on the completion of the work. All chimneys to be topped out as per elevations with pressed brick laid in red mortar. The fireplaces throughout to be laid up with white fire brick laid in yellow mortar. The kitchen fireplace to be laid up with select hard burned red brick and in red mortar.

Bluestone.—Furnish and set in kitchen a rubbed bluestone shelf and hearth, to be the size as marked on the plans. Turn trimmer arches to all fireplaces. All hearths laid with ornamental tiles and borders, size as marked on the plans. These tiles to cost not less than sixty cents per square foot, selected by the owner.

Plastering.—The walls and ceilings of all the rooms and apartments where shown must be lathed and plastered with two good coats of sand, lime, and hair mortar, brown finish and scratch coat, an additional coat of white hard finish, composed of best hard finish lime and plaster. All lime must be thoroughly slaked, and made up at least eight days before using in the building. All of the plastering must be done in the best manner, and the repairing and patching must be finished on the completion of the building, and all work to be left in a perfect condition. The underside of all staircases to be plastered where required by the plans. All exposed plaster corners to have rule joint.

Plaster Cornices.—All the principal rooms on first and second stories, including second story hall, to have plaster cornices 8" down on side wall and 10" on ceiling. Also set and furnish center pieces in each of said rooms, to cost $5 each.

Cellar Bottom.—The cellar bottom must be leveled off, packed, and settled thoroughly, and covered flush and smooth with cement concrete 3" deep in three parts of clean, coarse, sharp gravel and one part paste and Portland cement, and the entire surface to be flushed up even and true. Around the sides of the main walls form gutters sufficient size to carry all the water to the drain. Over the mouth of the drain place an iron strainer, and leave the whole job or work in perfect order.

CARPENTER WORK.

Timber and Framing.—First floor joists, 3" × 10", 16" from centers ; second floor joists, 3" × 10", 16" from centers ; third floor joists, 3" × 9", 16" from centers ; ceiling joists, 2" × 8", 24" from centers ; rafters, 2" × 8", 24" from centers ; hips, 2" × 8" ; partitions, 3" × 4", 12" from centers ; door studs, 3" × 4" doubled ; wall plates and ties, 4" × 6" ; bridging, 2" × 2" ; sills, 4" × 8" ; posts, 4" × 8" ; girths, 4" × 6" ; valleys, 3" × 8" ; bridges, 2" × 10" ; piazza sills and bearing timbers, 3" × 8" ; piazza floor beams, 2" × 8", 20" from centers.

All other necessary timber required throughout the building to be good, sound yellow pine timber, well seasoned, sawn true and square, free from sap, shakes, dry rot, or other imperfections ; and all timbers used throughout must be prepared and framed according to the plans, sections, and details. All joists to have the crowning edge placed upward and sized to proper widths. Also prepare and size all studding, etc., cross bridge all joists at distances not exceeding eight feet apart. All trimmers and headers must be framed double, and in no case allow less than two inches between chimney breast and trimmers. The studding also to be of yellow pine.

Wood Lintels.—The carpenter must provide and set

all wood lintels of every kind and description for all windows, doorways, and other necessary places. All lintels to have a bearing on walls of at least two inches on each end.

Partitions.—All partitions throughout the building to be set according to the plans. Bearing partitions on first floor must foot upon the girders below and be capped on second story with plate for the reception of the joists. Bearing partitions on the second floor to foot upon plate. The studs at angles to be thoroughly spiked together before being placed in position. All doors to be trussed over the top thoroughly and substantially. All partitions to be set to a straight edge. Joist in all cases to be doubled up under all stud partitions. Grounds put on for finish throughout the building. Bridge partitions once in their height with 2 × 4, cut in horizontal, well nailed.

Cutting for Pipes.—The carpenter must do all cutting for pipes of all kinds, using care not to cut off or weaken supporting timbers, and furnish all necessary pipe boards for the plumber to screw his pipes to.

Sheathing.—The building to be sheathed on the outside with sound matched ⅞" boards not to exceed 9½" in width, nailed to every bearing through each edge with 10d. nails; these boards to be placed on frame diagonally. Cover this with No. 16 Manila building paper, well lapped under door and window casings and corner boards.

Lumber.—The lumber to be white pine, unless otherwise specified. All inside finishing lumber to be clear and dry, free from sap, shakes, or knots, pitch, etc.

Exterior Finish.—All of the exterior finish for corner boards, window and door casings, cornices, water tables, verandas, 5" beveled sidings, and all manner of finish shown on plans and details to be composed of clear lumber, well seasoned, and primed as soon as put up. Shingle the vertical sides where shown on the plans with 6"×18" cypress shingles laid not more than 5" to weather and cut to pattern.

Furring Strips.—Do all necessary furring of every description.

Roofs.—All roofs to be covered with rough boards 1" thick, with good square edges, and of even thickness. All of the rough carpentry necessary to form the projection of eaves, as required for all cornices, gutters, etc., to be done in accordance with the plans and details. All to be composed of good, sound lumber, and put on in a good, substantial manner. All roof boards to be well nailed with 10d. nails. Joints broken at various places. All main roofs to be covered with the best quality of hard black slate.

All floors, when not otherwise specified, to be of yellow pine, free from sap, shakes, black, unsound or loose knots, mill worked, tongued and grooved, 1" thick, not over 3" wide. The attic floor may be 9½" flooring. All well and secret nailed to each joist. The porch floors to be of yellow pine, tongued and grooved, ⅞" thick, not more than 3" wide, and all joints to be well laid in white lead. The kitchen floor to be composed of yellow pine, tongued and grooved, ⅞" thick, not more than 2" wide. All the floors to be composed of lumber, the best of the several kinds specified, and all well and secret nailed to every beam. The dining room, library, first story main hall, stair platform, water closet, and bath on second story main house to have an ornamental hard floor with an ornamental border. Allow for this floor 60 cents per square foot, not including the laying. This floor must not be laid until after all the other work is finished. The pattern of this floor will be selected by the owner.

Doors.—All doors in the house except where otherwise specified to be made of clear, dry lumber free from sap, and must be in strict accordance with the drawings. Size of doors to be marked on floor plans for width, height, etc. The doors in the second story to be five paneled and flush moulded; doors on first story made as per details; all the others to be four paneled. All doors that are marked on plans as sash doors to have proper rebates for receiving glass, and suitable provisions for same, with beads, etc.

All necessary dwarf doors to be provided, where needed, for pantries, closets, wash stands, water closet, etc., paneled or battened and beaded, as the case may require. The front doors to be made of red oak, to correspond with the sizes and dimensions given on plans. All other doors required by the plans to be made in the best manner.

The sliding doors to be hung with Warner's patent door hangers, the track boxed in as per furnished directions. The double doors to have astragal joint in center. All to be well and securely done. Pockets for sliding doors to be made perfectly air tight.

Hinges.—Hang all doors throughout with butts of sufficient size to throw them clear of architraves. Butts on front doors to be of plain bronze, 5" × 5", three to each door. Butts on first and second stories of main house to be 4½" × 4½", plain bronze. All doors to have 4½" saddles and rubber tipped base pins where needed. All dwarf doors throughout to have suitable butts to match other work, and all door butts to be loose pin joints. First and second stories, main house, to be real bronze plain knobs, roses, and escutcheons, front doors to have plain bronze knobs and escutcheons and roses combined. Kitchen to be 4" × 4" lacquered butts, and white porcelain knobs and escutcheons. Sliding doors to have real bronze flush trimmings. Put suitable knobs on all dwarf doors, press doors, etc. First and second stories to have bronze face mortise locks and striking plates. The main entrance doors to have a 6" mortise lock night latch attachment, with three keys, and to have real bronze fronts and striking plates. Sliding doors to have locks and astragal fronts of real bronze and flush furniture. All small closets, presses, drawers, etc., to have suitable locks as approved. All door locks throughout to be of the best city manufacture, and all doors to have a key. All double swing doors to have bronze flush bolts top and bottom.

Picture Moulding.—Put up 2" picture moulding in all principal rooms and halls, first and second stories. Wood to match the trimmings in their respective rooms.

Window Frames and Sash.—All window frames constructed to correspond with the working drawings for same. The sash to be size as shown and 1¾" thick, and hung on braided sash cords, weights, and noiseless axle pulleys. All glass to be well bedded, bradded, back puttied, and cleaned off. All provided with best approved bronze sash locks and lifts. All made of clear lumber well seasoned. Cellar sash 1½" thick and hung on butts and fastened when shut or open.

Glass.—The glass in first and second stories to be French polished plate; all the balance to be double thick French sheet, second quality; put in stained glass where shown on the elevations; this glass to be leaded inland to cost $3 per square foot.

Hardware.—All hardware and trimmings used throughout to be the best of the kind specified; furnish all necessary bronze hardware for bath room.

Interior Finish.—All to be constructed as required by the plans and details, with sound, clear, kiln-dried lumber as follows: the main hall and staircase to be red oak; library and dining room, white oak; parlor, reception room, bath room, and water closet to be cherry; the kitchen and connecting pantries to be Georgia yellow pine; all doors and windows to match in their respective places. The second story to be finished in cypress.

Corner beads with turned ends put on all exposed plaster corners, wood to match that of the rooms. The bath room and water closet to be fitted up as shown. Panel backs under windows first and second stories and stair platforms; all windows, including those that have panel backs, to have neat stools and aprons.

Stairs.—All stairways to be built where located on plans. The main staircase to be built and supported on three plank strings, the risers to be 1" thick, and the treads 1¼" thick. Dimensions in all cases for height of risers and width of steps to be measured from the building. The space under stairs to be finished with a neat panel. All stairways must be put up after the plastering is dry.

Newels, Rails, and Balusters.—The newels, rails, and balusters for main staircase to be worked in accordance with the detail drawings. All cellar and outside stairways to be built on good, strong plank strings, provided with plank steps of yellow pine, well put up and thoroughly secured. The main newel will be 10"×10" base, 8"×8" shaft, carved and chamfered, main rail 3×3½". Balustrade to be the same as shown on the details.

Kitchen Pantry.—The kitchen closet to be fitted up with five shelves about 14" wide. Fit up pantry as shown, to have counter shelf, with small doors or drawers below as directed and small glass doors above these lockers, to have small moulded cornice run around the top. Furnish and set all necessary hardware to make the job complete and to match that in its immediate vicinity. The opposite side to be fitted up with bins and lined with tin, these bins to have paneled covers and hinged complete. All the bed room closets to have two shelves each supported on rabbeted cleats continued all around. The under shelf to have a hook strip underneath, and bronzed wardrobe hooks secured thereto.

Kitchen Sink.—The sink to be ceiled up underneath with narrow beaded battens, and provided with door of same, fitted and trimmed with the required hardware, and to have hardwood drainer.

Wainscoting.—Wainscot walls of kitchen with 2½" beaded strips, 4' 0" high, with neat cap moulding on top, also servants' bath room wainscoted in same manner. The water closet and bath room on second floor to be wainscoted 4' 0" high with same kind of wood that the rooms are finished with.

Mantels.—The mantels, either slate or wood, will be furnished by the owner, and set by the contractor.

Bath Room.—Bath tubs to be cased up in a good and workmanlike manner. The water closets to be fitted up with cover, seat, and riser. Hang the seat and cover with bronze butts. The whole should be put together so that at any time they may be easily taken apart for the purpose of attending to or repairing the plumbing pipes. Fit up the wash bowl underneath with narrow ceiling 2½", and provide batten door of same, properly fitted, hinged, and trimmed, with appropriate butts and catches.

Blinds.—All the windows to have outside rolling blinds made in the best manner, hung and fastened complete when shut or open, except stained glass windows, cellar windows, front windows in hall, parlor, reception room, library, and bay window in second story; these to have Venetian blinds, the wood to match the rooms in their respective places, stained glass windows excepted.

Tinning.—All the flat roofs must be covered with the best I.C. charcoal roofing tin, laid with flat seam. The gutters to be properly lined, and run the tin up under the slate or shingles at least 6"; bring the tin over the face of the cornice and tack it down smoothly. All angles and other necessary places to be covered with tin as above, all well soldered in resin, and make perfectly watertight. Leaders of XX tin put up as indicated on plans, or as may be directed, with all necessary curves, breaks, bends, etc., to carry the water from the several roofs to the ground, and connect the tile drain, which will be put in by the mason. Leaders to be of 3" caliber and thoroughly secured with iron hooks as directed. Where tin work of roofs comes against building, the tin must turn into the bricks and be thoroughly secured with gas hooks. All proper and necessary flashing of every description furnished, painted on both sides, and inserted wherever necessary to make the job complete.

Painting.—All the exterior wood work usually painted to be painted three good coats of white lead and linseed oil paint; all knots and sap to be well shellacked before priming; all cracks, joints, and nail holes, and over nail heads, to be well puttied after priming is done. All tin work to have two coats of metallic paint; all the colors to be selected by the owner. The blinds will be painted at the factory. The interior will be wood filled with Wheeler's wood filler, then two good coats of hard oil finish. The whole will be rubbed down to a smooth surface. All the door saddles, hearth borders, and hard floors will be finished in same manner.

PLUMBER'S SPECIFICATION.

Drain.—Furnish and put in, where shown on the plans, a 5" cast iron soil drain pipe to run from inside of building out to the tile drain 4' outside of the building.

Soil.—Furnish and connect with the soil drain in cellar a 5" cast iron pipe, and run same size up and out of roof at least 4', and cap the same with the "Smith" patent ventilating cap. Use Y branches for all waste connections. All the iron soil pipe to have a coat of asphaltum. The soil pipe to have a cleaning-out cap in cellar.

Calking.—All joints of all iron pipes are to be thoroughly calked with picked oakum and molten lead.

Boiler.—Furnish and put up, where shown on the plans, a 35 gallon round head heavy pressure copper boiler, and provided with draw cock for emptying the boiler, and shut-off cocks for shutting the water off from second story, and provided with circulating pipe, complete. Connect boiler draw cock with the sink waste, have a ⅝" stop cock on supply pipe, and combined safe and vacuum valve on top of the boiler. Boiler to be supplied with a Lockwood stand.

Supply.—Tap and pay for tapping the water main, and connect a ⅝" AAA supply and run to the boiler. Supply to have a shut-off cock inside the cellar wall. Each floor to be controlled separately by shut-off cocks.

Sink.—Furnish and set up, where shown, in the kitchen, a 20"×6" galvanized iron sink with back, air chamber, and iron legs, and supply with hot and cold water through ⅝" AAA lead pipe and cocks, and have 1½" C lead waste pipe properly trapped and connected with the drain, with a 2" iron pipe to the main soil pipe. To have a cleaning cap on end of pipe under sink.

Bath.—Furnish and put up, where shown, a 16 oz. sheet copper bath tub, 4½" long, well tinned and planished. Supply with hot and cold water through ⅝" AAA lead pipe and nickel plated combination bath cock with rubber spray, to have 1½" C waste, and properly trapped and connected with the soil. Bath to have nickel plated plug and chain. Overflow to be connected with waste. Fit up servants' bath and water closet same as described for above.

Bowl.—Furnish, and set where shown on the plans, a 14" marble Italian ware wash bowl, with marble countersunk top and subbases 10" high. Supply with hot and cold water through ½" AAA lead pipe and nickel plated patent basin cocks. To have 1½" C lead waste properly trapped and connected with the soil.

Closet.—Furnish, and set where shown on plans, supplied with water through 1¼" pipe from cistern above, a porcelain wash-out closet, with suitable size cistern. The cistern to have the flush tank attached. Supply through ⅝" AAA pipe, and have cistern valve and rubber ball complete. Ventilate the closet with a 3" lead pipe connected with the iron vent. Closet cup to be nickel plated. Closet to have enameled drip tray.

Range.—Furnish and set complete in kitchen fireplace a range, selected by the owner. Make all necessary connections to water back, and have throat piece complete.

TWO DWELLINGS OF MODERATE COST.

We give sketches and floor plans of a couple of dwellings of quite moderate cost from designs of Mr. John E. Baker, for which we are indebted to our excellent cotemporary, *Building*. These dwellings have a pleasing exterior appearance, while the interior arrangement is all that could be desired.

Mahogany.

Mr Henry Seymour says: The population of Honduras is made up of Jamaica negroes, who perform all the heavy work there is in getting out mahogany and preparing it for shipment. We cannot hire our help direct, as the northern pine contractors do their hands, but are compelled to go through a lot of red tape, which practically ends in making the men we employ our slaves for a year. The law of the land requires us to appear before a government magistrate, resembling our justice of the peace, and we are obliged to give bonds in the sum of $2,000 for each man as a guarantee that his wages will be promptly paid, that he will be provided with regulation rations and be given proper treatment. We also have to pay all the men hired in this manner three months' pay in advance. The wages are $12 a month and weekly rations of four pounds of pork and twelve pounds of flour for common choppers and laborers, and $18 a month for "captains" or foremen, who also receive as extras an allowance of coffee and sugar. The men go to the woods in squads of ten, a foreman in charge, and do not return to the place of starting until the year rolls around. When they do return the town is painted a bright vermilion, and the jollification takes the semblance of a jubilee. It is ofttimes necessary to lock the men up after they are hired, and after the advance money has been paid, to prevent them from jumping the job. It is also quite advisable to start the squads for the fields of operation as soon after hiring them as possible, for a like reason.

Mahogany trees do not grow in dense forests like pine, but are found scattered through the jungles. Indian hunters are employed to seek them out, and they receive for such service one dollar for every tree discovered. When a tree is found it is quickly marked for its new owner, and is reported and registered. Roads are then constructed from the trees and to the streams in the vicinity by piccaduras, and the choppers follow and do the cutting. The trees grow on stilts, so to speak, their roots extending to a height of 10 or 15 feet, and there being many of them to support the main trunk. A staging is built around the trunk above the roots, upon which the men stand to chop, using long, straight handled axes. When the tree begins to totter the choppers jump for their lives, the occasions not being unfrequent when one or more of them are unsuccessful in retaining this precious boon. The tree is sawed into logs, and rough hewn to a shape nearly square. They are then hauled to the river upon rude and heavy trucks and floated down stream to the barcadilla, where they are beaten until they are perfectly smooth and square, and then the logs are loaded upon the vessels and shipped to England and France, a comparatively small quantity coming to this country.

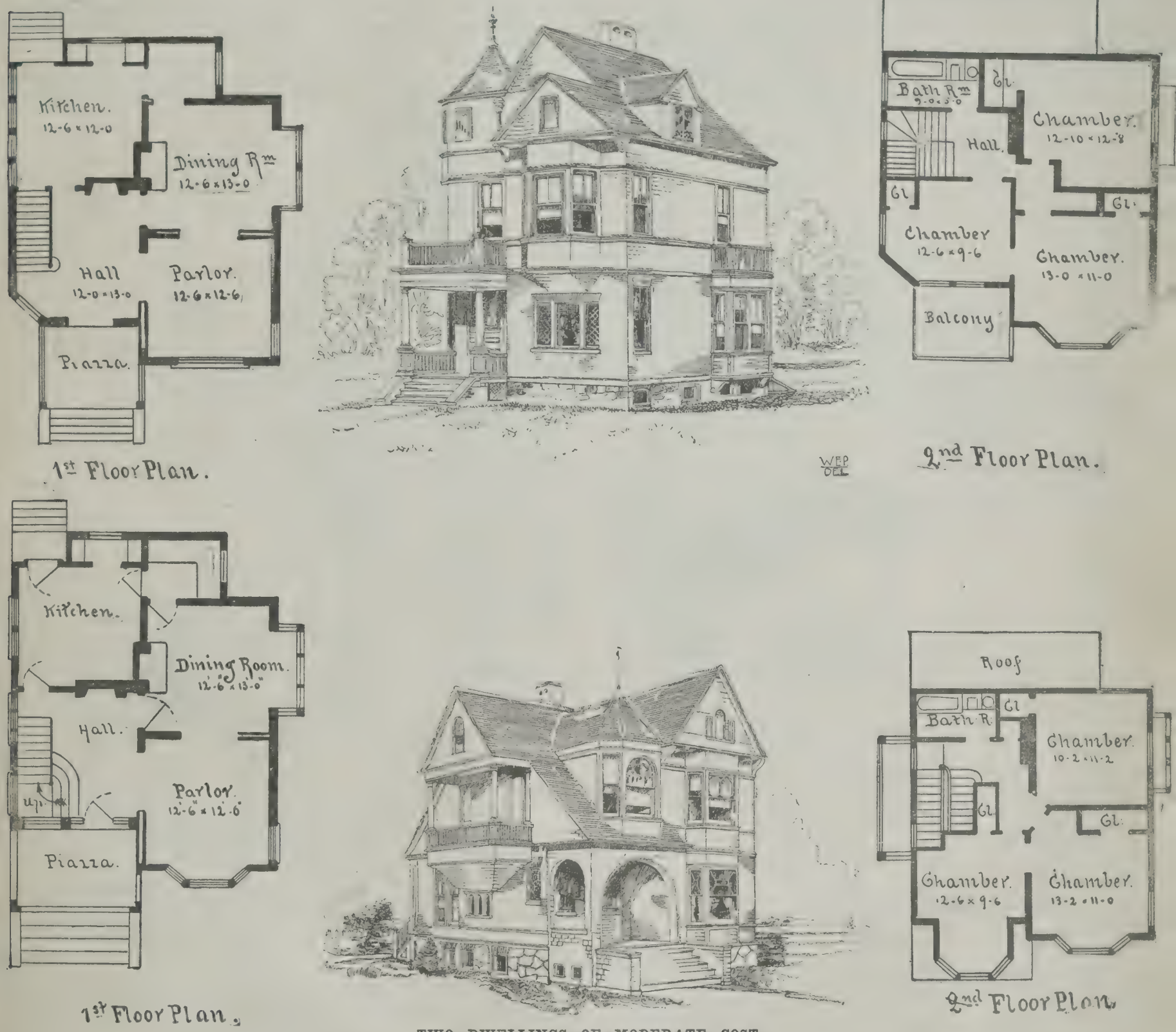
Some of the mahogany trees are immense in size. Last season my men felled one that was seven feet in diameter, containing 6,000 feet of lumber, and we have another tree listed that is nine feet in diameter, which will measure upward of 10,000 feet. Trees of this size have to be split before handling, and we use dynamite cartridges for the purpose. There are eight or ten companies operating along the coast, and we pay the government three dollars for every tree we cut on public land, and five dollars a thousand export duty. The mahogany interest in Honduras is in its infancy, as thus far it has only been possible to work along the coast and streams. Two new railroads are projected which will open some splendid mahogany fields, and as soon as the roads are completed lumbering will be conducted upon a much larger scale. The Grand Rapids men interested in the industry are satisfied with their experiment thus far, and are much pleased with the prospect for the future.—*Northwestern Lumberman.*

Vibration of Buildings.

At a recent meeting of the Engineers' Club of Philadelphia, the secretary presented, for Mr. C. H. Ott, an account of a peculiar case of transmission of vibrations and pulsations through structures. Annoying, and even serious, vibrations, in this case, were found, by direct experiment, to be occasioned in a building at one end of a solid row 400 feet long, by the operation of a small engine running a spice grinder in a retail grocery store at the other end of the row.

A general discussion of vibrations in structures followed, participated in by a large number of members, and numerous instances were noted. Mr. John T. Boyd described vibrations, in a large office building, that had never been satisfactorily accounted for; Mr. Henry G. Morris, in a large hotel, created by the elevator pumps; Mr. Howard Murphy, the relative effects of the earthquake on different floors of an office building; Mr. F. W. Whiting, where the fourth story of a five story mill building, in Philadelphia, vibrates ⅜ in., and a mill building in Massachusetts, where the vibration is so great as to cause nausea among new employes, and where the water cannot be kept in a fire bucket, yet the building is probably at least ten years old and seems to stand it.

Mr. Joseph M. Wilson referred to the evil effects of continuous vibrations in structures, and noted, incidentally, a case in his recent practice where large marble blocks had been broken by the freezing of water in the lewis holes; Mr. Howard Murphy referred to the vibration in the large Scotch stacks; and Mr. Henry G. Morris noted the case of a stack 125 ft. high, where the vibration was 1½ in.



TWO DWELLINGS OF MODERATE COST.

A CARRIAGE HOUSE AND STABLE.

Size of Structure.—Front, 22′ ; side, 32′.

Height of Stories.—First story, 11′ ; loft, 5′ at plate.

Materials.—Foundation, stone ; first and second stories, clapboards ; roof, shingles. Cost, about $1,500, complete.

The floor plan shows accommodations for two horses, and there is also room for cows, a coachman's room, harness room, and a good sized carriage room. The porch on front is intended to be used as a stand for washing carriages. Plenty of room in loft for a winter's supply of hay and feed for two horses.

A CARRIAGE HOUSE AND STABLE.

Building Accidents.

Accidents to buildings are, in many cases, primarily due to faulty foundations. Walls are placed on inclined ledges, in some instances even those overlaid with clay, without cutting steps in the ledge in order to remove any horizontal component due to the load of the structure. At the present time I have knowledge of a building resting on an inclined bed of clay which has already moved about six inches in a horizontal direction, and although only one story in height it is fissured with cracks, and only held together by means of numerous and unsightly tie rods. Such accidents are frequent in buildings placed on the banks of rivers.

Under certain conditions, buildings have been injured by reason of too broad foundations; that is, when placed upon compressible earth, portions would settle unequally. A very high mill which was recently taken down in Eastern Massachusetts to make way for one of modern construction and corresponding facilities for manufacturing had settled under the walls about three inches more than under the columns, making the floors more like a ship's deck than is usually found on land. Such injury may be obviated by the use of the system of independent foundations, which are so arranged as to impose a uniform load per square foot upon the earth. Some of the buildings in Chicago have been erected upon such foundations, receiving a uniform load of about two tons to the square foot, and the settlement of such structures is uniform, and without injury to the building, while it is well known that many buildings in that city have been very seriously injured by unequal settlement.

Another difficulty in foundations, especially those under mill buildings, has been due to springs or to water oozing from the canal furnishing the water power and percolating under the walls.

Other injuries have owed their origin to the decay of piles which were cut off at a grade above that of the water stratum in the earth; and there have also been difficulties arising from the transverse yielding of the piles in the soft earth of the Back Bay, Boston, which was caused by the horizontal stress from the roadway; although these mishaps have been infrequent except in the case of the approaches to the highway bridges in that portion of the city.

A frequent error in floor design is caused by the endeavor to obtain an economical distribution of material by increasing the depth of the beams and diminishing the width, so that the intensity of pressure at the points of support exceeds what should be permitted for conditions of safety, and such beams sometimes shear off near the points of support rather than break by bending. The resistance of wood to transverse pressures is about one-third that of compression in the line of the grain, and it is noticeable that the transverse contraction by seasoning amounts to three-eighths of an inch or more per foot. A due consideration of these facts should prevent any one in the design of a mill structure from placing wooden bolsters over the columns and transmitting the load from one column through the bolsters and beam to the column below; but rather let each column be surmounted by a cap of at least three times the area of the cross section of the column, and above this an iron pintle should run to the plate forming the base of the column above. In this manner the whole resistance of the column can be utilized and the building saved from being thrown out of line, with the attendant deterioration and injury to machinery by the aggregate movement due to the transverse contraction of the beams and pilasters, which reaches an excessive amount in the upper stories of a high building.

The most frequent cause of depreciation of buildings arises from dry rot of timbers, which can generally be avoided by allowing the air to have free contact with the timber, and the application of whitewash or plaster on wire lath seems to preserve timber as well as protect it against fire. There have been some instances where the plaster has been covered with stucco for decorative purposes, completely sealing the timber against the air, and this in turn has been followed by dry rot.

The use of tinned coverings upon large timbers and doors for the purpose of defense against fire is apt to cause dry rot when the lumber is imperfectly seasoned. And, as such tinned fire doors have served their purpose better than any other type of fire doors, it is important that they should be constructed of well seasoned stock.

A similar cause of dry rot results from attempts at decoration by varnishing partially seasoned timber, which completely seals it up, and furnishes the most perfect expedient that can be adopted to accomplish this end. It requires at least six years after the building is finished to season Southern pine timbers one foot in width.

Beams are frequently sealed so tightly where they enter the wall that dry rot takes place within the walls, while the exposed portion of the beam within the room is entirely sound.

A large mill was built a number of years ago, just previous to the failure of the corporation, and lay unoccupied for about five years. When the property was sold, the new owners did not dare to place machinery in this mill until the beams had been removed and new ones substituted. The portion of the beams in the rooms was entirely sound, the decay being limited to the portion built into the walls.

The general method of construction to obviate the difficulty is by building pilastered walls containing vertical flues into which the end of the beams project, while at the side of the beams, and on top, a slight air space is left during construction.

It is proverbially well known that wood will withstand decay when kept either entirely wet or absolutely dry. The piles that supported the houses of the prehistoric dwellers over the Swiss lakes and the wood in the tombs of Egypt both attest the accuracy of this statement. But in a more familiar way it may be noticed in the beams used in wet places around water wheels, where timber pressed against a wet ledge will decay toward the wheel, where it is exposed to dampness, and remain perfectly sound at the end which is constantly wet.

Much has been said and little done about the antiseptic treatment of timber, the most valuable contribution to the subject being contained in the *Transactions of the American Society of Civil Engineers*, Vol. IV., page 274; but the difficulty with all preparations has been their solubility in water or their expense. Lime seems to be the most perfect preservative for wood as long as it can be kept in contact with it. Exposure to water, which will remove the lime, will, of course, leave the wood defenseless, although one may notice in the old style paper mills operated by overshot wheels that the portion of the wheel receiving the lime refuse thrown out from the bleaches will remain sound, while the rest of the wheel will decay with a rapidity dependent upon the character of the water in the stream and the lumber employed. The general value of lime as a preservative of wood may be noted when one considers the admirable condition in which laths are always found. I doubt if any one ever knew a decayed lath to be removed from contact with plaster.—*C. J. H. Woodbury, in Amer. Architect.*

A HOUSE FOR SIX THOUSAND DOLLARS.

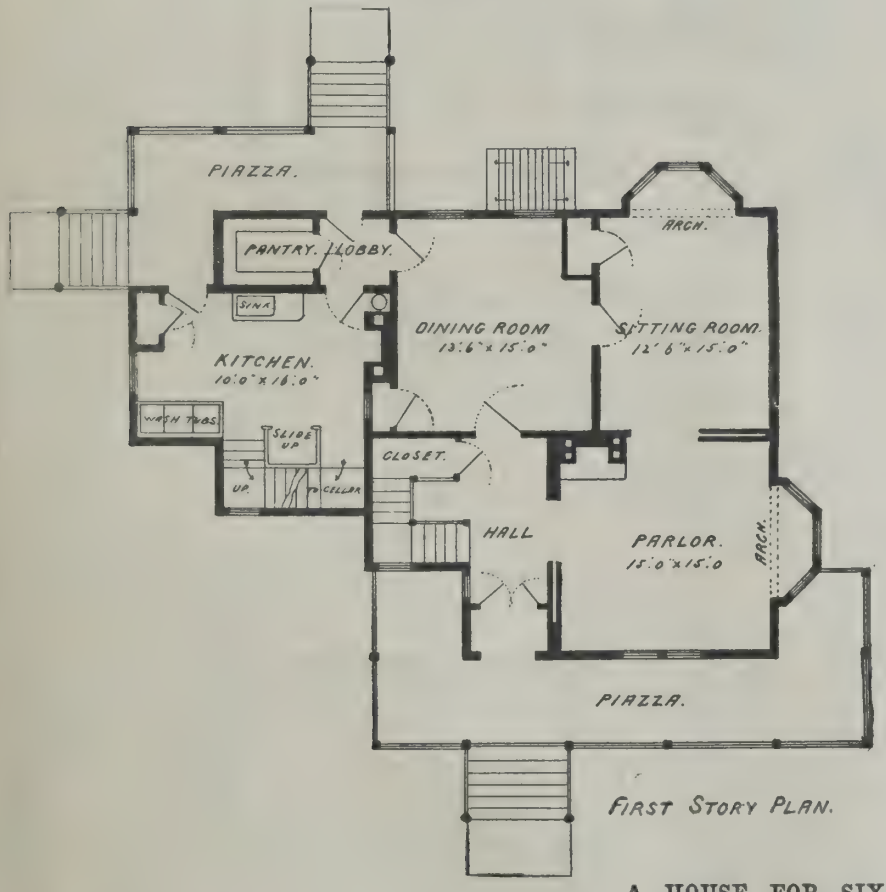
This house has a front of 49', not including piazza; side, 34', not including piazza.

For size of rooms, see floor plans.

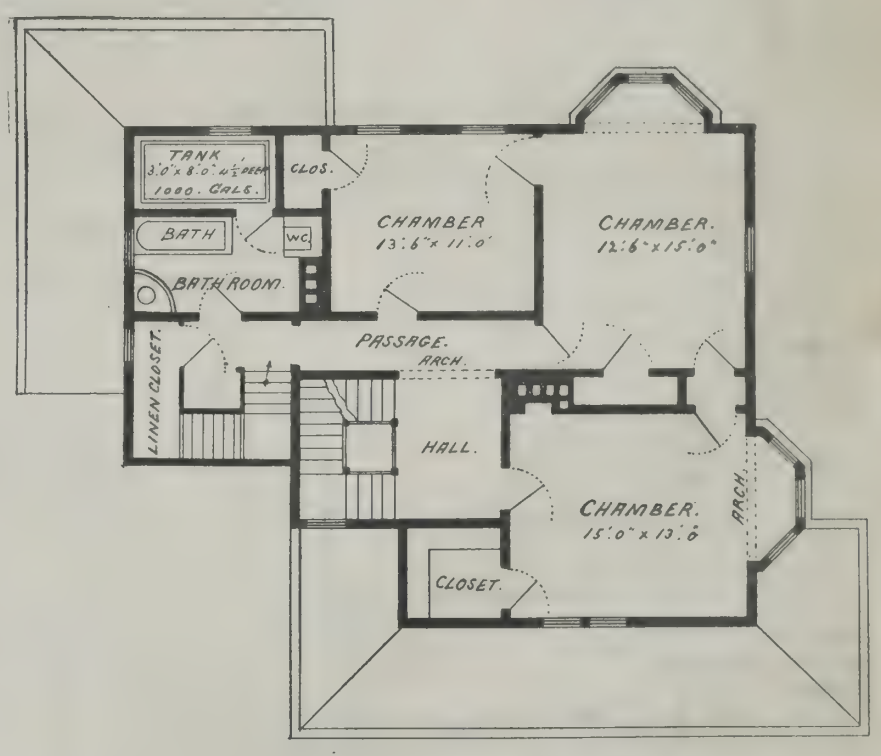
Height of Stories.—Cellar, 7'; first story, 10'; second story, 9'; attic, 8'.

Materials.—Foundation, stone; first and second stories, clapboarded; gables, shingled; roof, shingled. Cost, without mantels and heater, $6,000.

Special Features.—Open fireplace in parlor and one chamber on second story. Four of the principal rooms have fine bay windows. Cellar under the whole house. It is designed to have three rooms and hall finished in the attic.



FIRST STORY PLAN.



SECOND STORY PLAN.

A HOUSE FOR SIX THOUSAND DOLLARS.

The Column Vendome, Paris.

When the column in the Place Vendome was erected, a bargain was made with an iron founder who had never been engaged in bronze work. He, however, had the temerity to undertake the moulding and finishing at one franc per kilo, or say 9d. per 2 lb. The government undertook to deliver to him in guns, taken from the Russians and Austrians during the campaign of 1805, the quantity of bronze necessary for the completion of this enormous monument. The founder used a furnace he had for casting iron, but not being aware of the phenomena of bronze casting, and urged by his vanity to attempt in the first instance the casting of several of the great pieces of the base of the column, he encountered several defeats.

Each time he necessarily altered the alloy by oxidizing the tin, lead, and zinc, which metals so oxidized passed into the scoriæ or were carried off by the current of warm air. He did not perceive this cause of continual loss and continued to produce the bass-reliefs; but it may be readily conceived that they contained more copper than the bronze of the guns. When the founder had got two-thirds through the column, he found out that he had got no more metal, and being, according to contract, responsible for the metal delivered to him, he was at once ruined. In this lamentable situation he tried to melt up the white metal obtained from the reduction of the scoriæ and a large quantity of refuse metal which he had bought up at a low price. The bass-reliefs which he obtained from the mixture of all these materials were marked with blotches and lead spots; their color, from a dirty gray, became black.

The authorities refused to receive work so defective, and put his foundry under sequestration. He succeeded, after much petitioning, in obtaining a committee to examine his accounts, which was composed of two chemists, two architects, two mechanical engineers, and two founders, with an auditor of the council of state for the chairman. The weight of each piece delivered by the founder was known, specimens were taken from them, and the proportional parts weighed, from which was made an ingot representing the mean composition of the whole column. It was then found by analysis that it contained 89 parts of copper, 7 of tin, and 3 of lead in 100 parts. The committee then took specimens of bronze from the guns remaining in the government stores, and an ingot was formed to represent as nearly as possible the mean composition. The analysis of this ingot gave 89 parts copper and 10 of tin. It was further known that the law in France had fixed the composition of gun metal at 90 parts of copper and 10 of tin per cwt., but that this law was never well executed, and during the revolution scarcely attended to at all. It was also known that these foreign guns were of a more complicated and baser alloy than the French. Taking all these circumstances into consideration, the committee were of opinion that the founder had produced an alloy, if not superior, at least equal, to that which had been given to him, and that they considered that he could not be charged with fraud in his contract. By making separate analyses of the specimens of the great bass-reliefs, the shaft, and the capital, it was found that the first had only 0·06 alloy per quintal, the second, particularly toward the upper part, and the third, contained as much as 0·21.

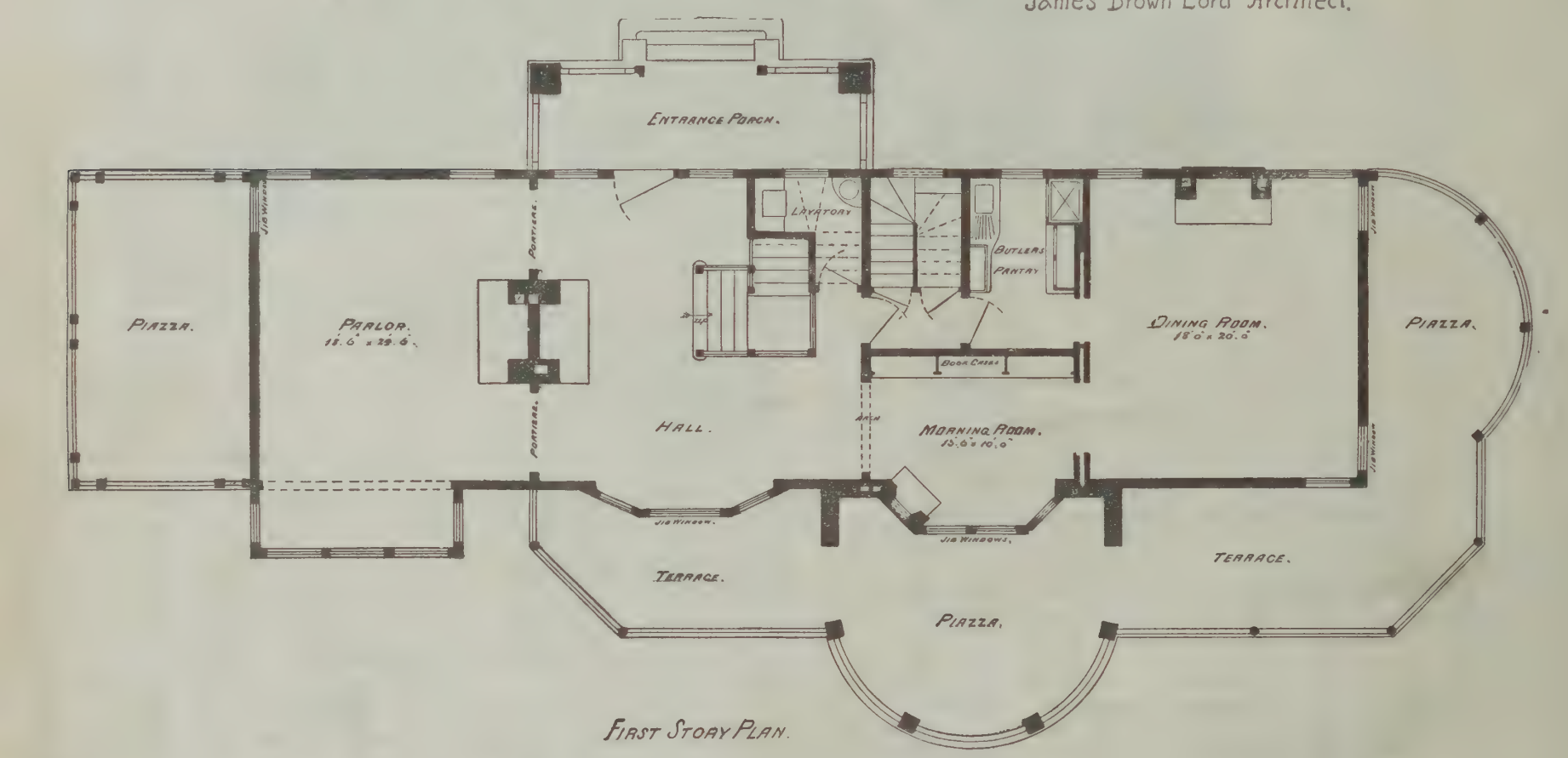
It was, therefore, evident that the founder, not knowing how to manage bronze, had refined his alloy by several times remelting, and consequently diminished the total weight, and that to make up for his loss he was obliged to put into the last castings the white metal extracted from the scoriæ. Thus he had given bronze of too good alloy in the beginning, which had obliged him at last to make the alloy too low. The moulding of the several bass-reliefs was so badly executed that the chaser employed to go over them removed by chiseling or filing a weight of bronze equal to 70,000 kils. (7 tons), which were given to him, besides a sum of 300,000 frs. (12,000*l.*) paid down.—*C. Daly.*

MAHOGANY has realized the hopeful anticipations entertained by operators at the close of last year, and made sturdy strides into favor of consumers both local and interior, some operators estimating the increase of demand at fully fifty per cent.—a figure in a great measure confirmed by the record of importation. The natural merits of this beautiful wood, combined with more perfect arrangements for moving it forward from primary sources, and increased local facilities for cutting and dressing under the management of energetic and determined manufacturers, has more than restored the setbacks of previous years, and placed mahogany in the front rank of fashionable woods for all really first class work.—*N. Y. Real Estate Record and Guide.*

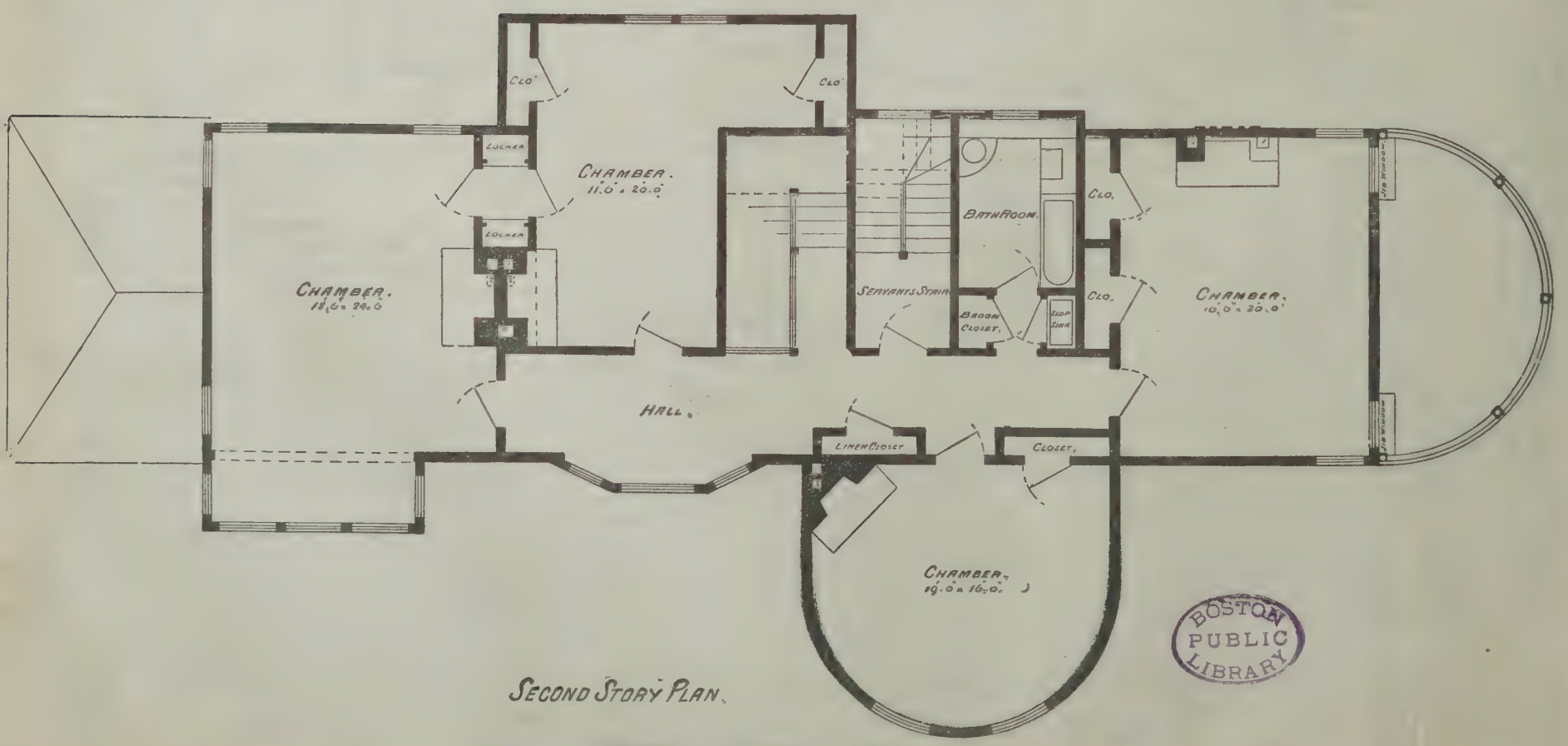
HOUSE AT TUXEDO PARK.

Tuxedo Park is one of those charming country resorts among the hills of New Jersey where New Yorkers seek for rest and quiet from the excitements of city life. It is about an hour's travel from the metropolis. Many beautiful homes have been erected within a few months past at Tuxedo, and among them is the substantial residence herewith illustrated, designed by James Brown Lord, architect, of this city.

House at Tuxedo Park for Miss Breeze
James Brown Lord Architect.



First Story Plan.



Second Story Plan.

HOUSE AT TUXEDO PARK.

A SEASHORE COTTAGE.

We present a perspective and two plans of a Cape Cod cottage, which we find in *Building*, designed by C. E. Miller, architect, of this city. It is plain, comfortable, and quite moderate in cost.

Learning to Design Buildings.

Under this title Professor T. Roger Smith, F.R.I.B.A., lately delivered a free public address, at University College, London, as an introduction to a new course of lectures on "The History of Architecture, Construction, and Modern Practice."

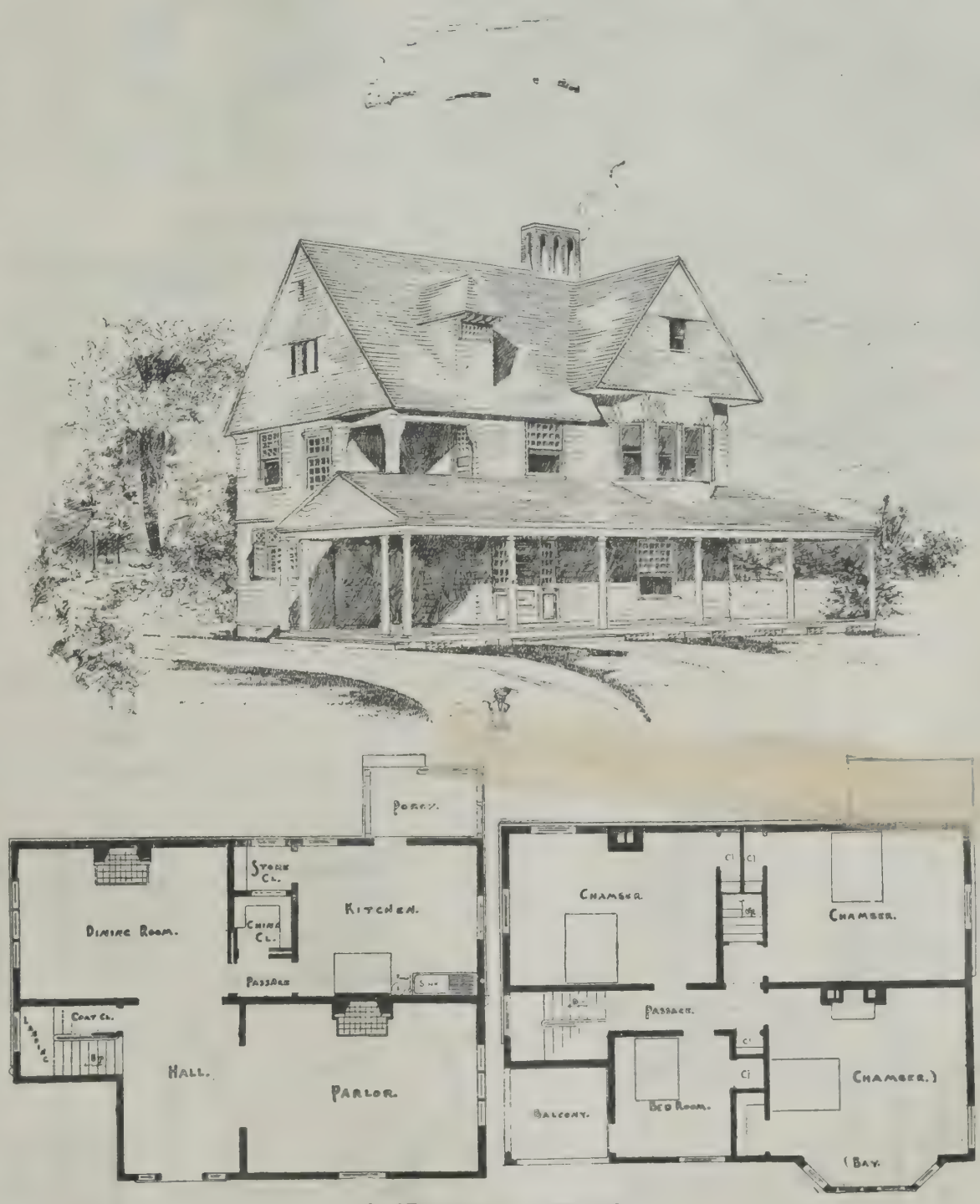
Although designing buildings was believed by many people to be the sole occupation of an architect, this belief was, the lecturer pointed out, an error, as it was only a part of his work, but the part, however, which earned for him the distinction of being an architect. The services which a good builder, an accurate surveyor, a correct draughtsman, rendered to the progress of a building were most important; but it was the architect's duty foreseeing what the result was to be, to say what each of them was to do.

His plans represented a building which as yet, in actual fact, did not exist. His specification described it, the quantities dissected it minutely, the perspective view represented it on the spot where it was to stand with its light and shade, its grouping, its outline, and all its qualities, while as yet it had no existence. It was this art of originating a new building, or part of a building, which was meant when we talked of architectural design. This process was the crucial difficulty in the profession—to master that difficulty was to accomplish success; to be mastered by it was to fail. Designing was admittedly difficult, but so was everything which was worth doing.

The first thing to do was to ask what it was we proposed to originate when we attempted to design architecture—what, in fact, was a building. A building was indeed a very complicated affair, not to be easily described or defined. It must possess, however, four main characters in order to be regarded as architecture. First, it was a contrivance; the art of disposing the plan of a large building so that each room it contained should be of the right size and shape for its intended use, and that the access to and communication between all should be convenient, that each part should be well lighted, and the whole so put together that there should be no lost space, was that of planning. As the purposes of buildings were very various, a vast amount of general knowledge was desirable for an architect, and this needed to be not only varied, but accurate. Secondly, a building was a structure as well as a contrivance, *i. e.*, it was put together piece by piece, and made up of a series of different materials. The due employment of the various materials, such, for example, as bricks, stones, lime, sand, slates, tiles, timber, iron, lead, copper, and glass, required to be understood and allowed for in the design, and in a good building each was made to serve its turn.

A building, moreover, was exposed to ceaseless attacks, seen and unseen which tendered to wear it down and destroy it. The action of wind and weather, the heat of the sun, the force of storms, fire, flood, damp, drought, neglect, use and misuse—these and a thousand other agencies were conspiring to shorten the life of every building, and were too often assisted by the insecurity of foundations and the unsoundness of workmanship.

Young men began their studies with the notion that buildings were erected to stand, but they would by slow degrees realize that they were actually built to collapse, and that it was only a question of time when that would take place. Designers should so construct a building, therefore, as to employ every material upon the duty to which it was best fitted, and should so provide for the soundness of the structure that decay should be warded off as long as possible, and as much resistance as possible should be offered by the fabric to its many enemies. A building might also be regarded as an economy—using the word in its larger and primary sense of a well managed undertaking—a wise and well judged administration of a certain definite measure of resources. There was such a thing as economy of material. Marble was a finer material to build with than brick, but even were it plentiful, it would be false economy to prefer it to brick for the exterior of buildings exposed to a climate like that of London. Ornament, again, was the life of a building, but if the whole structure were covered with it, the effect would not be half so rich as if a sufficient amount of plain surface had been preserved to make a contrast. A building should, therefore, be well contrived, soundly constructed, judiciously economized; but it must not stop there—it should also be a work of art.



A SEASHORE COTTAGE.

The humblest lodge designed so as to please a cultivated taste was better architecture than the mansion to which it gave access, if the latter were vulgar, ostentatious, ill-conceived, or shapeless. Designing had to do with all these things, and had to take cognizance of them all. A design that failed in any of these respects was so far a bad one, and a building erected from it would not be an architectural success, but it was especially necessary that it should not fail as a work of art. The artistic merits of a design depended not a little upon the designer's having recognized and conformed to the requirements, often exacting enough, of arrangement, construction, economy, but they consisted chiefly in the added grace and effect.

If every designer of a building had in respect of even the more ordinary requirements to master all from the beginning as though it had never been done before, the undertaking would be overwhelming. Fortunately, buildings had been erected successfully ever since civilization began, and we inherited these from our forefathers. While in every structure there was much that was old, there should ever be something that was new if the work was in any sense to be regarded as original.

The first duty of the student of construction was to learn what was already generally accepted; and if something not previously tried, or not on all fours with known past experience, became requisite, then he had to draw upon his power of designing new construction as well as selecting old. The same rule held equally good in the economy of building.

Last, and of chief importance in designing, were the qualities that made the building a work of art, and here the same principle held good—our designs should contain much that was old, but something that was new.

Non-Inflammable Wood.

At the requisition of the Belgian Minister of Public Works, M. Boudin and M. Donny, professors at the Ghent University, have conducted a series of experiments and investigations in connection with rendering wood uninflammable. The following *resume* embodies the conclusions at which they arrived, as set forth in their report to the minister.

Although wood cannot practically be rendered so fireproof as not to be destroyed by heat, it is very possible to deprive it, to a considerable extent, of the property of catching and communicating fire, and to this end it is sufficient to coat the wood with a suitable composition.

It is not, however, sufficient that this composition or substance possess in a high degree the property of rendering wood uninflammable. It must also fulfill other conditions. The treatment must not involve an expense out of proportion with the purpose to which the wood is applied, nor should the process be such as to delay the rapid execution of works. Nor should the substance employed be liable to attack any metal parts which it may be necessary to use with the wood.

The process should also be of easy application, with a brush for instance, the only manner in which it can be applied to existing structures. The wood thus coated should present a neat and tidy appearance, and should also be capable of receiving a coat of ordinary paint over the fireproofing composition. Nor should one or the other coat be subject to alteration after a moderate lapse of time.

If, instead of coating, the method of injection be employed, certain substances, notably chloride of calcium, should be rigorously excluded, because they would keep the wood constantly damp. The injection method is easily applied to small articles by simple immersion, and it is preferable that the composition or solution be hot, if not boiling. The possible diminution of strength due to all injection processes should also be taken into account, although the results of experiments are not conclusive on this point.

It follows from the above considerations that wood cannot be rendered incombustible, or, more strictly speaking, non-alterable by heat, but its non inflammability may, to a considerable extent, be insured so as to preserve buildings from a limited and temporary fire, at any rate until assistance arrives. It is, however, hopeless to expect a building encumbered with inflammable substances to pass through such a test uninjured.

The methods of preserving wood against fire are of two kinds: the injection of saline solutions and the application of a paint or coating. The former appears but little practical, and, indeed, short of proof to the contrary, it must be considered dangerous in the case of wood of large dimensions. This system is, however, applicable to small pieces of wood. Of all the substances recommended, a concentrated solution of phosphate of ammonia is undoubtedly the best, the use of this substance, notwithstanding its high price, possessing such great advantages that it should be em-

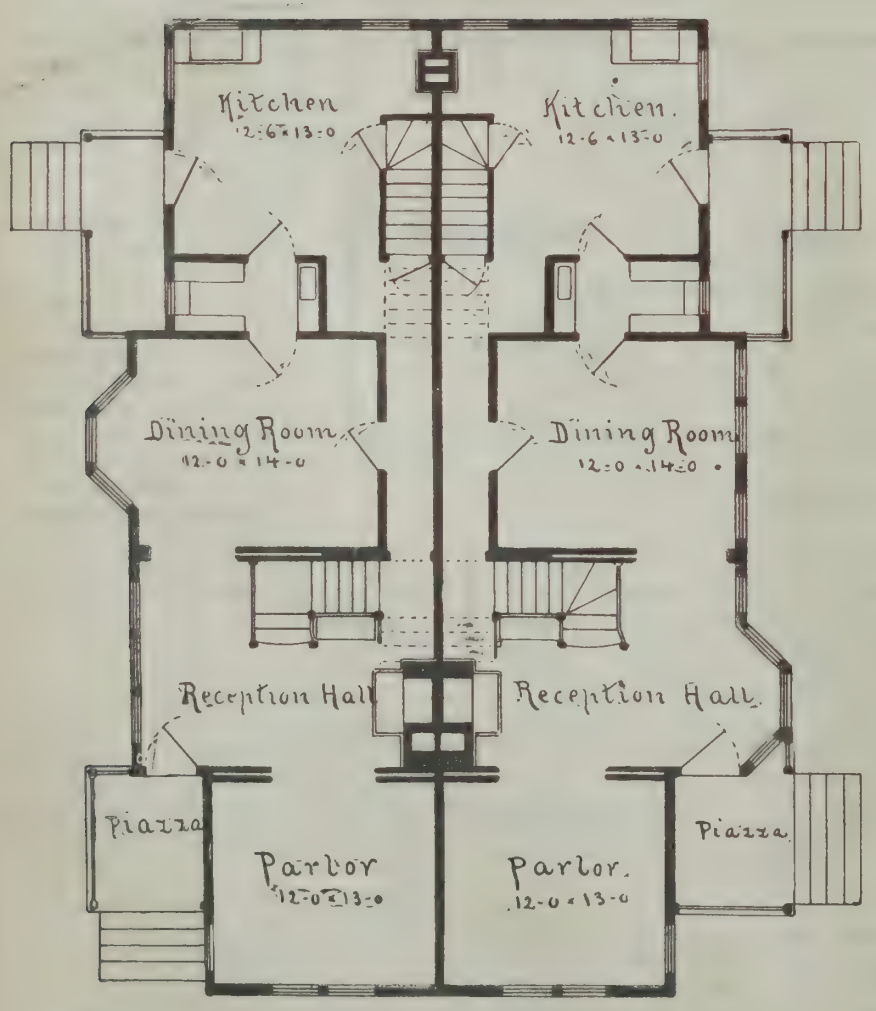
ployed in all cases where expense is no object. In the majority of cases, however, coating with a brush is the only practical solution of the question, and the substances most to be recommended for use in this manner are cyanide of potassium and asbestos paint.

A DOUBLE HOUSE OF MODERATE COST.

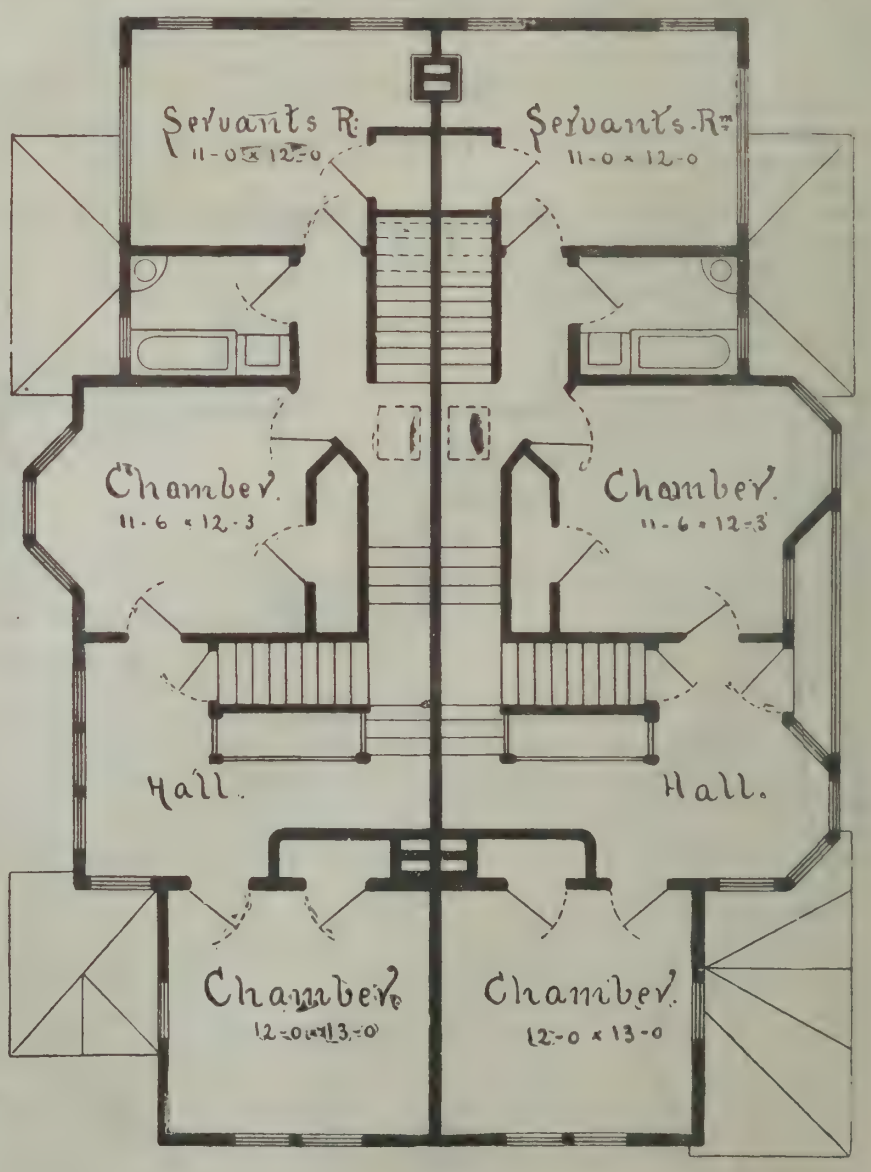
We present herewith an attractive plan for a double house, to be substantially built and estimated to cost about $6,500. The design is by Mr. C. T. Beardsley, Jr., architect, Bridgeport, Conn.

The arrangement of the reception hall, parlor, and dining room is good, and in fact each house is designed for convenience and comfort in all respects. The sizes of the rooms are stated on the floor plans.

A SIMPLE method of providing a deodorizing "flush" for water closets arranged with a cistern is described as follows in the *Sanitary News:* Fill a quinine bottle with permanganate of potassium and cork it securely. Bore two holes in the cork with a large pin, and fasten it, by the aid of wires, mouth downward, in the cistern, so that when this is full it will be completely submerged. See that the holes are large enough to permit the water in the cistern to become sufficiently charged with the deodorant. The above supply of permanganate is sufficient to last several months.



First Story Plan.



Second Story Plan.

A DOUBLE HOUSE OF MODERATE COST.

Proposed Alterations to House at Great Neck.
Front.

James Brown Lord. Architect

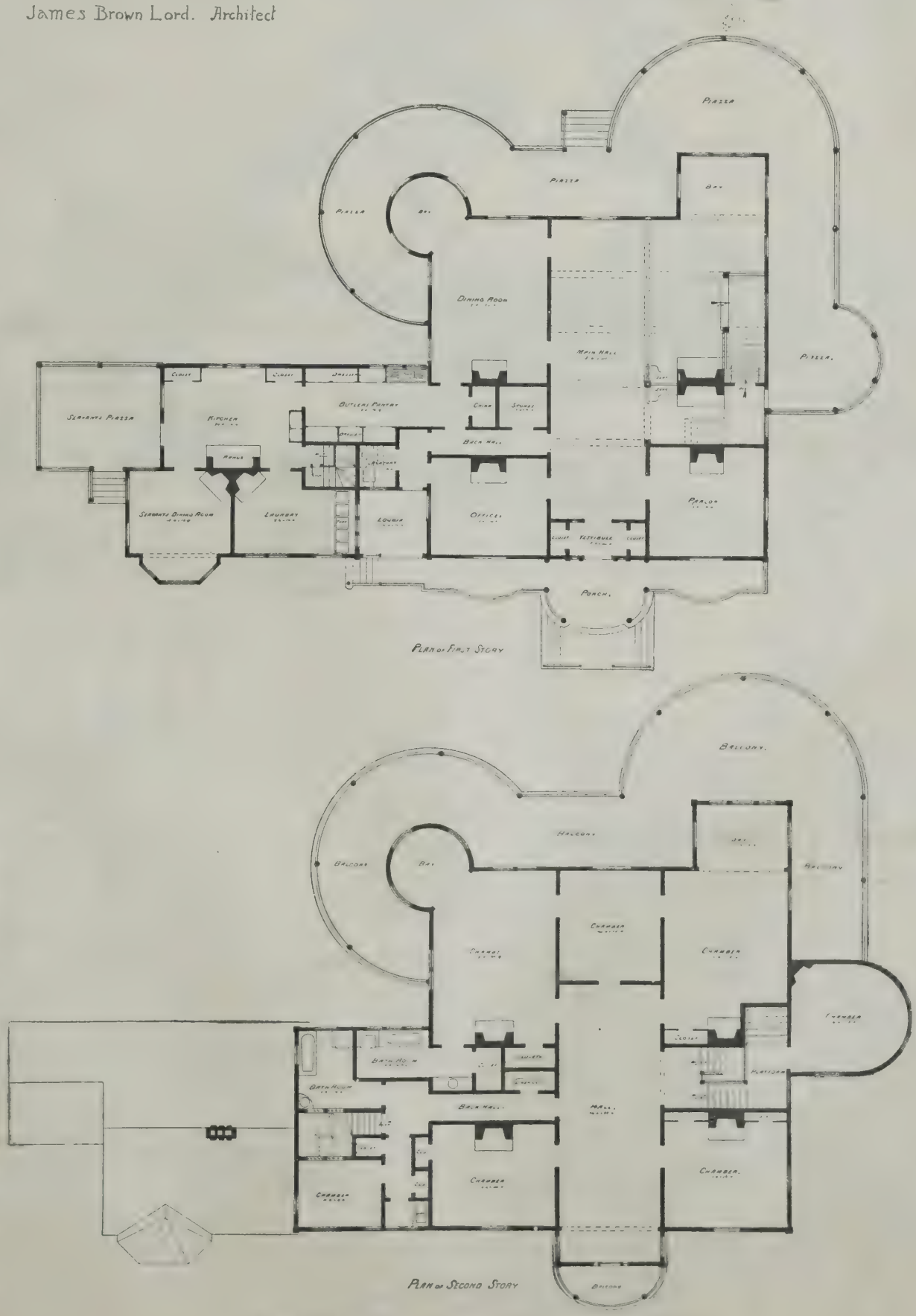
ALTERATIONS OF A LONG ISLAND DWELLING.

We give the elevation and plans of an alteration of a dwelling on Long Island, which presents several interesting features. The change in the exterior appearance will be seen by comparison with the small sketch of the old house. Besides the exterior change an elaborate new staircase was put in, new mantels, tiles, etc, and new plumbing, thus converting the building into a modern dwelling of most comfortable character. Architect of the alterations, Mr. James Brown Lord, of this city.

Large Redwood Boards.

Every one has seen some of the wide planks of redwood which occasionally appear in the Eastern markets, but few persons outside of California know the gigantic dimensions in which redwood lumber may easily be obtained from mills which possess machinery capable of sawing it. We remember seeing once a solid redwood plank five feet wide, which was the admiration of the building portion of the town for a time; but, according to the *California Architect*, this was small compared with some to be had in the vicinity of the redwood forests. Not long ago the managers of a State fair in California sent circulars to the saw mills, inviting exhibits of redwood planks. In response to this a certain mill sent a "good sized" plank, which measured six feet in width. Hearing of this, the proprietors of another mill worked up some planks eighty inches wide, and sent samples for exhibition. And soon afterward a third establishment, the McKay mill, forwarded a lot of perfectly clear, sound planks and boards, varying in width from ten to eleven feet. If there were any special demand for such enormous pieces of this unrivaled timber, they would be more frequently seen, but the wood construction of the world has for a thousand years been based on the assumption that sawed sticks measuring more than twelve inches in breadth or depth of section would be costly, and difficult to obtain. And a new system must be made to suit the materials of the Pacific coast, or the redwood logs will continue to be subdivided into pieces approaching in size the Eastern lumber. On the other side of the water, the standard of size for framing timber is still smaller than with us. If we are not mistaken, few mediæval cathedrals on the Continent contain a stick larger than eight inches square in cross section, and, although English timber was of larger dimensions a thousand years ago, there would be little difference now. —*Amer. Architect.*

A BILL has been introduced in the New York legislature making every railroad corporation legally responsible for any damages caused by fire "communicated directly or indirectly by its locomotive engines." By the use of good spark arresters on the locomotive, most of such fires would be obviated, and it seems as if railroad companies should be held responsible for the damage done from such cause.



ALTERATIONS OF A LONG ISLAND DWELLING.

A ONE STORY RESIDENCE.

Our sketch shows a one story residence erected at Birmingham, Ala., from the designs of Sutcliffe & Armstrong, of that city. We have here the spacious veranda, the central hallway, and convenient apartments all so desirable for dwellings intended for warm climates. The general effect of this design is pleasing and satisfactory. We estimate the cost of this dwelling at about $4,500. For our sketch we are indebted to our excellent cotemporary, the *Architectural Era*.

An Experiment on the Expansion of Iron in Buildings.

The recent death of the venerable Thomas U. Walter, the American architect, as announced a few weeks back, recalls an interesting experiment which he made on the expansion of iron in buildings. At the time—half a century ago—there was some apprehension of the consequences which might arise from the use of iron in connection with brickwork. Mr. Walter had proposed to introduce iron bands as a means of resisting the thrust of arches in Girard College, Philadelphia. It was to be an immense building, the dimensions of the stylobate being 159 feet on the fronts by 217 feet on the flanks, and the cell, or body of the building, 111 feet by 169 feet 2 inches. The whole height, from the ground to the apex of the roof, is 100 feet. In each story there were to be four rooms of 50 feet square, those of the first and second stories being vaulted with groined arches, and on the third story the rooms were covered with domes springing from the corners of the rooms at the floor, and assuming a circular form on the horizontal section at a height of 19 feet. It was on account of this arching that iron bands were supposed to be requisite. In order to satisfy the building committee about the security of his proposals, Mr. Walter entered upon experiments of which he gave the following account:

The expansible properties of iron having been a subject of considerable conjecture in reference to the bands for resisting the lateral pressure of the arches, I was induced to make an experiment for the purpose of discovering the actual difference of temperature produced in the middle of the walls by the extreme heat of summer and the severest cold of winter. Although I have never had an idea that any evil could possibly result from the expansion of the iron in question by an increase of temperature, the materials which surround it being subject to an expansion almost (if not quite) equal to that of the iron, yet the satisfaction to be derived from positive evidence on the subject is sufficient to give interest to the experiment. I shall, therefore, give a brief account of the manner in which it was conducted, so as to enable you to judge how far the result may be relied on.

The place selected for the experiment was the brick wall between the south vestibule and the large rooms. The thickness of this wall is 5 feet 5 inches, and its distance from the south front of the cell 26 feet. The sun had, therefore, full power upon it during the summer, and in the winter the whole building was covered with a temporary roof. I should also remark that the experiment was completed before any fires were made in the furnaces.

On September 23, 1836, the temperature on the work being at 82 deg. F., a self-registering minimum thermometer was placed upon the iron band in the middle of the wall, and the brickwork constructed as solidly around it as the rest of the building.

On July 29, 1837, the temperature being again at 82 deg., a hole was made in the wall, and the thermometer taken out, when it was found that the register had descended to 42 deg. during the intermediate winter, the extreme cold of which was 3 deg. below zero. Thus we find the greatest cold in the middle of the walls to be 42 deg.

On January 16, 1838, the temperature on the building being 24 deg. F., a self-registering maximum thermometer was placed on the iron band in the middle of aforementioned wall, on the same horizontal line with the other thermometer, and about sixty feet distant from it, a space having been left in the wall when it was built for the purpose, which space was walled up around the thermometer as firm and compact as the rest of the work.

On December 16, 1838—the temperature on the building being again at 24 deg.—the walling was taken out, when it was found that the register in the thermometer had risen to 61 deg. during the intermediate summer, the greatest heat of which was 94 deg.

We have, therefore, 42 deg. for the lowest temperature of the iron bars and 61 deg. for the highest, making a difference of 19 deg.

The expansion that an increase of temperature of 180 deg. produces upon malleable iron is given by Dr. Ure, in his "Dictionary of Chemistry," as follows:

From experiments by Smeaton, $\frac{1}{769}$ of its length; according to Borda's experiments, $\frac{1}{865}$ of its length; and according to Dulong and Petit, $\frac{1}{848}$ of its length.

Mr. Hassler (of New Jersey), in his "Account of Pyrometric Experiments," read before the American Philosophical Society, June 29, 1817, finds the expansion to be equal to $\frac{1}{769}$ of its length. And in a work on natural philosophy, by Biot, we have the experiments of Lavoisier and Laplace, made in 1782, giving an expansion, under the same increase of temperature, equal to $\frac{1}{815}$ of its length.

The trifling difference in these results may be attributed to a difference in the density of the material.

Now, if 180 degrees will increase a bar $\frac{1}{769}$ of its length (this being the greatest expansion obtained by the foregoing experiments), 19 degrees will lengthen it only $\frac{1}{7526}$. Hence, the bands around the rooms of the college (each being 54 feet long from the points of support) will be subjected to a difference in their length, between the extreme heat of summer and the severest cold of winter, of $\frac{1}{7526}$, or $\frac{1}{12}$ of an inch.

This being the actual difference produced in the length of the iron bands by the greatest change of temperature to which they can be subjected, it remains for us to consider the expansibility of the materials with which they are surrounded.

A table of the expansion of different kinds of stone, etc., from an increase of temperature, is given by Mr. Alexander J. Adie, civil engineer, in a paper read before the Royal Society of Edinburgh, on April 20, 1835, in which he makes the expansion produced upon bricks by 180 degrees of Fahrenheit equal to $\frac{1}{1818}$ of their length, or $\frac{1}{26}$ of an inch in 54 feet under an increase of temperature of 19 degrees.

If, therefore, the maximum expansion of one of the iron bands in the walls of the college is $\frac{1}{12}$ of an inch, and the brickwork surrounding it $\frac{1}{26}$, the difference is then reduced to nearly $\frac{1}{28}$ of an inch, but if we consider that the variation of temperature in the interior of the wall is only 19 degrees, while the exterior is subjected to the extremes of heat and cold, it will be obvious that the aggregate expansion and contraction of the brickwork is even greater than that of the iron.

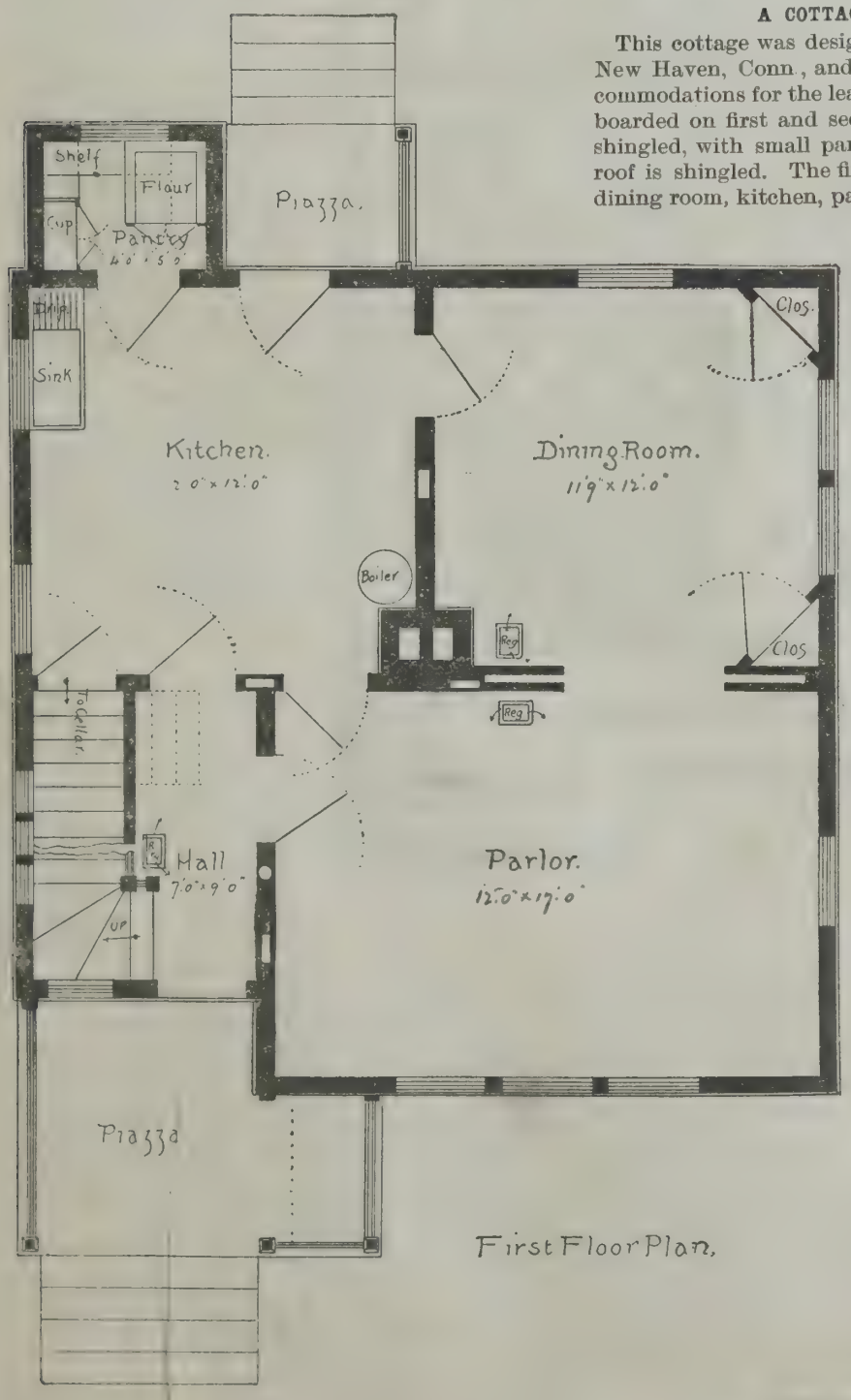
From these considerations, it is evident that not the slightest injury can possibly result from the use of iron in the construction of the college.

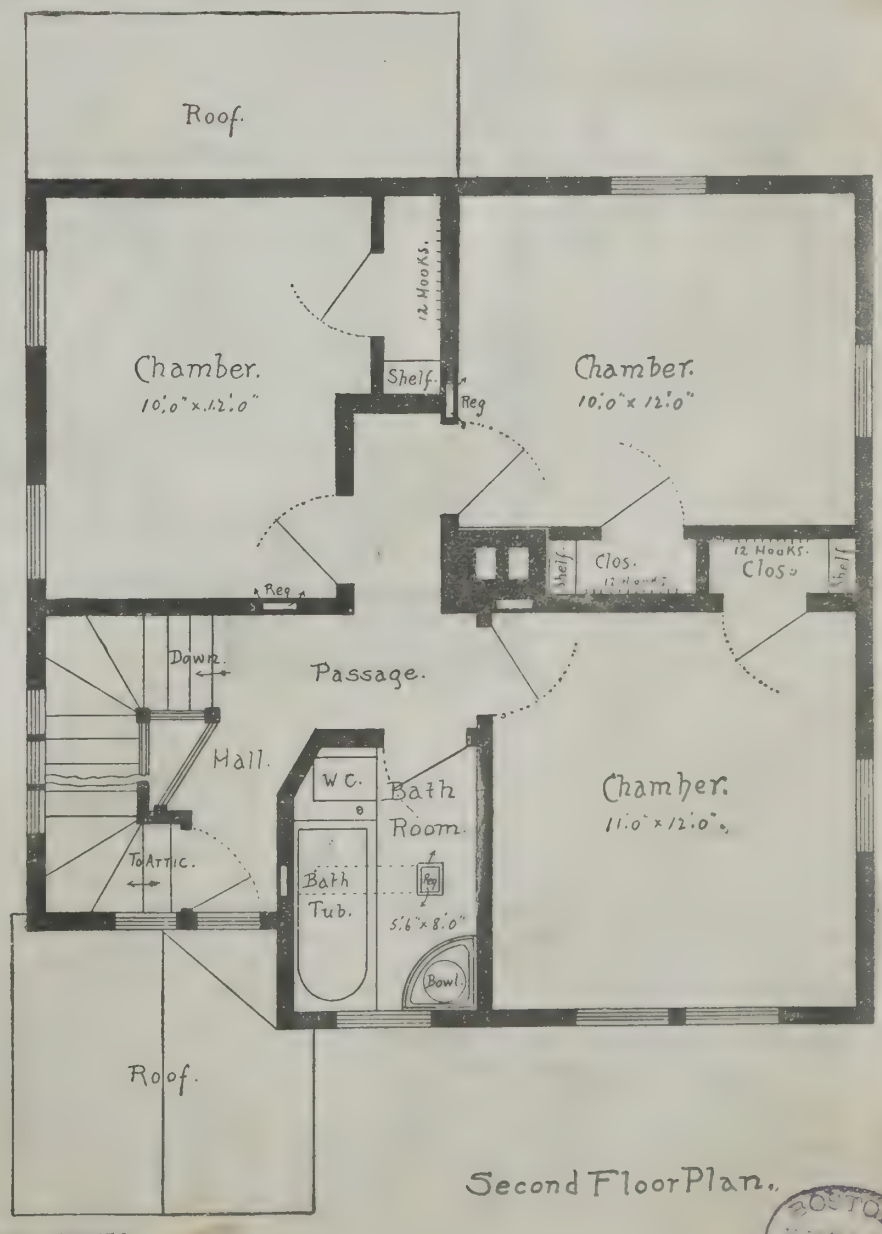
The results of Adie's experiments, to which Mr. Walter refers, are to be found in most books of technical tables and memoranda. They demonstrate how little difference exists in the relative expansiveness of the majority of building materials, and no danger could arise from a combination of them in a building. Since the time those experiments were made, more is known of the properties of iron; but as regards expansion, there is correspondence between the earliest and latest information on that subject. It will be seen above that the rule of expansion was put down at various figures between $\frac{1}{769}$ and $\frac{1}{865}$ of the length. The Britannia bridge affords a means of obtaining data without any chance of an error in the process. It is stated that the maximum motion of the tubes was 6¾ inches, and there is a uniform expansion of $\frac{1}{8}$ inch for each degree of Fahrenheit, or $\frac{1}{145000}$ part of the length. As the length of the bridge is 1,510 feet, if we calculate the effect of an increase of temperature of 180 degrees, we find it will be $\frac{1}{808}$ of the length, which is surprisingly near the proportion given by Lavoisier and Laplace. The Britannia bridge is not surrounded by materials of a corresponding expansiveness, and it is necessary to provide for the motion backward and forward, but in a building no displacement could follow with a corresponding variation of length in a girder.—*The Arch.*

A ONE STORY RESIDENCE.

A COTTAGE FOR $1,750.

This cottage was designed by J. M. Platt, architect, New Haven, Conn., and intended to get the best accommodations for the least money. The outside is clapboarded on first and second stories. The gables are shingled, with small panels above, in front one. The roof is shingled. The first floor contains hall, parlor, dining room, kitchen, pantry, and china closets. The second story contains three chambers and a bath room. Each chamber has a good sized closet fitted with shelves and hooks complete. The interior is finished in pine without paint. All the rooms are of good size, and are so arranged that each is convenient of access from all the others. The estimate for this cottage is seventeen hundred and fifty dollars ($1,750), not including heater.

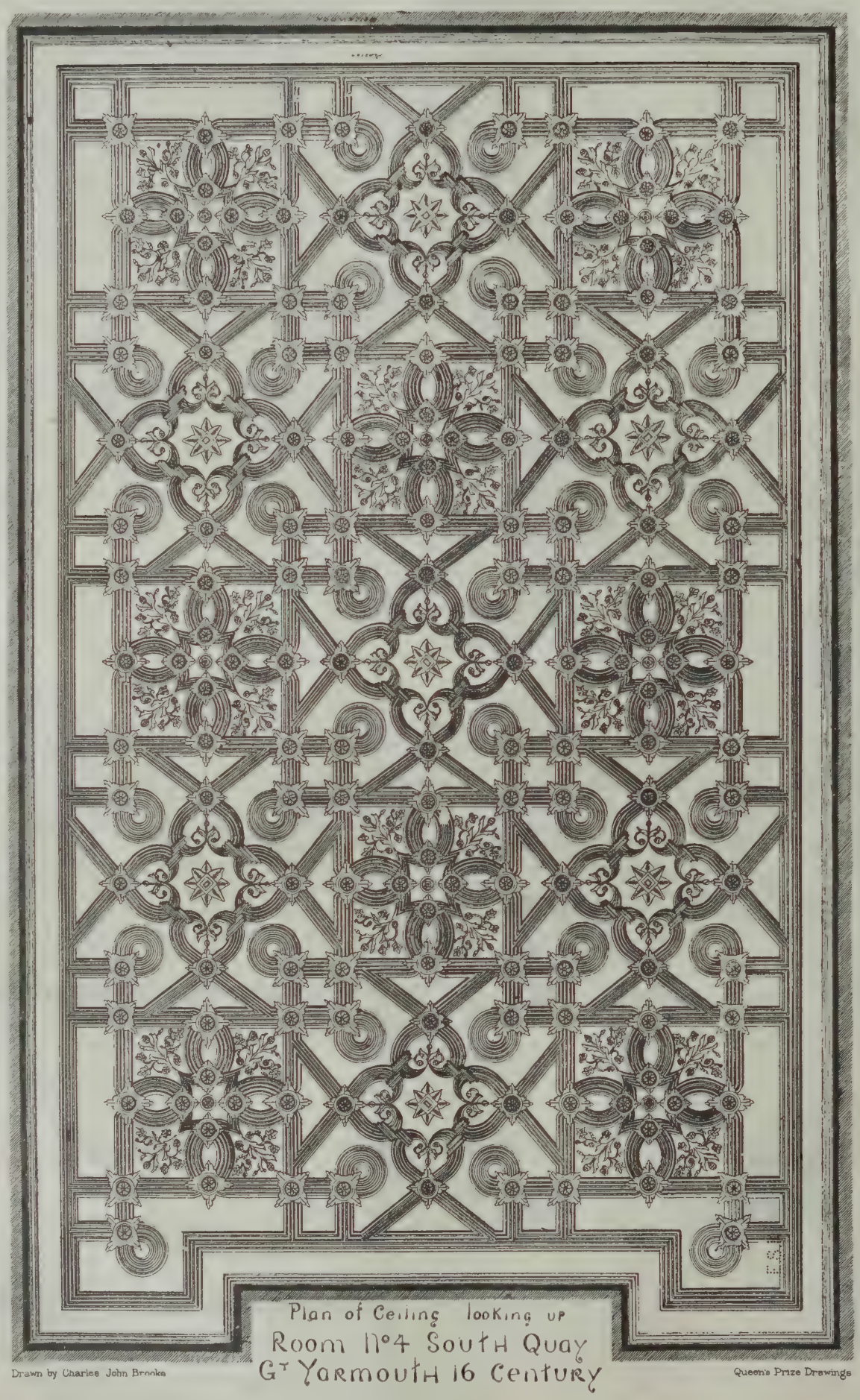




A COTTAGE FOR $1,750.

OLD PLASTER CEILING, SOUTH QUAY, YARMOUTH.

This plan, illustrating the beautiful ceiling in No. 4 South Quay, Yarmouth, forms one of the series of drawings for which the Queen's prize was recently awarded to Mr. Charles John Brooke, of Southtown, in connection with the science and art department. We hope at an early date to publish some of the other sheets from the same set, giving details of the screen and woodwork. The house from which this ceiling was taken is thus described in Manship's "History of Great Yarmouth," published in 1819: "The residence of Charles John Palmer, Esq., F.S.A. It was built in 1596 by Benjamin Cowper, a wealthy merchant of Yarmouth, and Burgess in Parliament for the town. The front has been modernized, but it contains a room on the first floor 30 ft. long by 18 ft. wide, elaborately adorned with carvings of great beauty and elegance, which remain in the most perfect state. The dining and other rooms are also paneled and ornamented with carvings." Although the date of this publication is some time back, the state in which they are at the present time, Mr. Brooke writes, fully justifies the above remarks.—*The Building News.*



Ornamental Hedges.

Few persons have any idea of the number of shrubs, both evergreen and deciduous, that may be successfully used in the formation of ornamental hedges. In the following paper I purpose describing, in as concise and plain a manner as possible, a few of the many plants that I have used with perfect success in the formation of live fences, and thus show that the monotonous repetition of privet, quick, and holly is by no means a necessity.

The Laurustinus (Viburnum tinus) is a very ornamental hedge plant and one that can be highly recommended for garden, lawn, or nursery subdivisions. It bears pruning well, and for this reason may be kept to any prescribed bounds, while its free-flowering nature entitles it to rank high among our more ornamental shrubs. In forming the hedge do not place the plants closer than twelve inches in single line, and in previously well prepared soil. By pruning or trimming the hedge immediately after flowering is past, a neat habit is brought about, while its free-flowering qualities are much enhanced.

Berberis Darwini is another excellent shrub for lawn or garden fences, it being of the freest growth, a perfectly hardy subject, and a most persistent bloomer. By placing young plants at twelve inches apart in thoroughly loosened soil, a very efficient fence is formed in a couple of years, and one, moreover, that has few equals from an ornamental point of view. Close trimming in of the shoots should be avoided, as then half the beauty of the fence is destroyed, nothing more being required but cutting or shortening back with a pruning knife any long, ungainly growths immediately after the flowering season is past. Peaty soil suits this barberry quite as well as the richest and freest loam; indeed, some of the finest, largest, and best furnished specimens I have ever seen were growing in a rhododendron bed on an estate in the north of Ireland.

The Holly (Ilex aquifolium) forms one of the most ornamental as well as useful of live fences. It may be kept in bounds by regular pruning, which it bears with impunity, while it grows rapidly where thoroughly established, and soon forms a wall of impenetrable green, and one of imposing beauty as well. Most persons are under the impression that the holly is difficult to transplant, but by lifting the plants with good balls of earth attached, during the month of May, this operation is rendered very simple. The holly is propagated by inserting cuttings in light, sandy soil in August, and keeping these moist and shaded in a cool frame or beneath hand-glasses until growth commences in spring. This is not the usual way, however, that commonly practiced being to raise the plants from seeds. Grafting of the finer varieties is usually resorted to.

The Common Yew (Taxus baccata) is another popular hedge plant, but its poisonous qualities preclude its use in positions where farm stock could browse on the foliage. For lawn or shrubbery use it is, however, invaluable, and is, perhaps, more commonly used for screen or other fences in such positions than any other shrub or tree. When perfectly established, the yew is of fairly quick growth, and as it bears trimming well, soon forms a fence of so compact growth that birds can hardly pass through it. The distance at which the yew may be planted in forming a fence will much depend on the size of the plants to be used, but for ordinary purposes those of say from two feet to three feet in height will be found most suitable, and should be placed at three feet or so apart. The yew is propagated in a manner similar to the holly, by collecting the berries when ripe, and either sowing at once or placing for twelve months among sand, so as to rot off the pulp or outer coating.

The Laurels, both common and Portugal, are excellent plants, and as they are of large growth, may likewise be used where a screen for unsightly buildings is required. The common laurel is very readily raised from cuttings, which should be inserted thickly in free sandy soil during August or September. The Portugal laurel is usually propagated by treating the berries in a similar way to that recommended for the holly and yew, or by layering. In forming a fence of the common laurel, large sized plants should be used and inserted at such a distance apart that the outer branches will just touch each other. The Portugal laurel being of stronger growth than the common form, must not be planted so closely, and as it bears transplanting when of large size, it forms a fence in a short time.

Cupressus Lawsoniana is another excellent hedge plant, and as it is now propagated in large numbers, it will no doubt be largely used wherever an ornamental evergreen fence is required. It is by no means partial to soil of good quality, but flourishes well in that of even very opposite descriptions.

Retinospora plumosa.—One of the neatest and prettiest hedges I have ever seen was formed of this shrub. Being of remarkably close growth and feathery in appearance, as well as of rapid development, no better subject for forming a lawn or garden fence than this retinospora could be chosen. At various times I have formed hedges of this shrub, and the result has always been satisfactory. It is well to use plants of large size, as immediate effect is then produced, and as all the retinosporas transplant with the greatest freedom, no risk is incurred by using specimens of from three feet to five feet in height. By placing these in well prepared ground and at just sufficient distance apart to allow the tips of the branches to touch, a good fence is formed in an almost incredibly short time.

R. plumosa aurea is a beautiful variety of the above with golden yellow foliage, but as it is as yet, comparatively speaking, scarce, few fences have been formed of it, although its close set habit and beautiful appearance render it peculiarly well fitted for such a purpose. The retinosporas are propagated from cuttings, and these may be inserted in boxes containing a mixture of loam, leaf mould, and sand, and stood in unheated frames or a cool greenhouse until roots are emitted, after which they may be lined out in the nursery for a few years previous to being placed in their permanent positions.

Fuchsia Riccartoni may by some persons be considered as an unsuitable shrub for hedge formation, but such is, however, not the case, for I have used it largely and with the utmost satisfaction for such a purpose. In England particularly it is quite hardy, and although during very severe winters it may be killed back nearly to the ground, yet by cutting away the dead wood in early spring fresh shoots are emitted, and these, in one season, reach a height of three feet or four feet. It is readily propagated from cuttings.

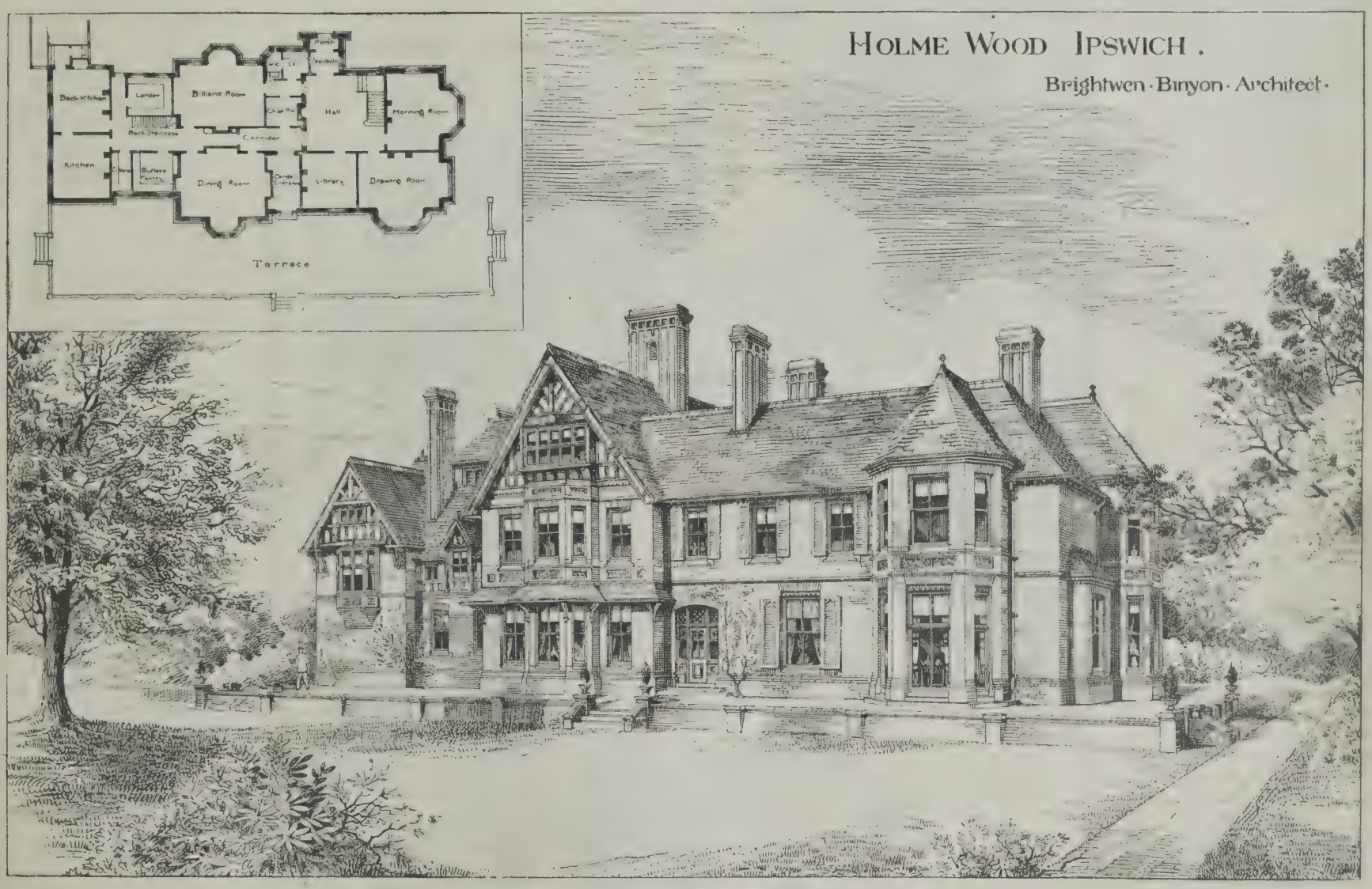
The American Arbor-vitæ (Thuja occidentalis) may be classed as a valuable fence plant, for when attended to in the way of pruning at stated and regular intervals, it forms a close and compact hedge of the most somber green. It may likewise, from its stiff and unyielding nature, be made to form a fence of considerable height, one of which that I saw lately being nearly six

feet high, and a perfect wedge of green. It bears trimming well, and for this reason may be pruned without the least fear of injury, but rather with decided benefit to the individual plants and fence as a whole. In forming the fence, good, large sized plants should be used—say of three or four feet in height—and these may be planted at a yard apart, in previously prepared soil of average quality. The American arbor-vitæ is propagated from cuttings.

Where the line of plants forming a fence is to be made, trench the ground over roughly three feet in depth and six feet wide, and should the soil be found of inferior quality, enrich it by a liberal dressing of thoroughly decomposed farmyard manure, nursery *debris*, good loam, or leaf mould. Planting should take place in autumn, and in doing so be careful not to insert the shrubs at a greater depth than they formerly stood in the nursery border. In some cases, more especially where ground game is very abundant, a wire fence run along each side of the newly formed hedge will prevent damage. An annual clearing of all weeds and dirt from the base of the hedge must likewise be attended to. Indeed, this is a matter of the greatest importance, although one that is far too often neglected.—*A. D. W., The Garden.*

HOLME WOOD, IPSWICH.

This house was built for Mr. J. E. Ransome, from designs by Mr. Brightwen Binyon, A.R.I.B.A. The plan



AN ENGLISH COUNTRY HOUSE.

was arranged with a view of retaining the shell of a house which was upon the site, but it was afterward determined to pull it down in order to improve the position. The house stands upon high ground in the center of several acres of well wooded pleasure grounds and gardens, about a mile from the center of the town. The view we publish here is from the southeast, the main garden front facing south. The building is of red brick, with Broseley tile roofs and some half timber work on the gables, etc. The contractors were Messrs. J. B. & F. Bennett, of Ipswich.—*Building News.*

The Acoustics of Buildings.*

Reflectors, sounding boards, and walls in close proximity to the singer or speaker augment and intensify the effect as a mirror augments light, and the resonance and sympathetic vibration of solid bodies is due to the reinforcement and enrichment of sound produced by instrumental sounding boards, such as those of a pianoforte or those of other stringed instruments, such as the violin or guitar, and of which no more striking illustration can be given than the familiar one of placing the stem of a vibrating tuning fork against a resonating body, such as a table or a hollow wooden box. The defects in large audience rooms, and even in small rooms, are brought about by one or more of the following seeming acoustic phenomena, and sometimes by all of them.

First, Dispersion.—This is where we have large and lofty buildings, such as Gothic cathedrals. The human voice is not powerful enough to fill the entire space, and the sound is left free to take the currents of air, and especially the moisture, and is lost among the arches and transepts, leaving but a small portion to reach the ear of the audience.

Second, Resonance.—This is caused by the solidity of the walls, sending back different notes, coming almost simultaneously with the first note sounded, and continuing some time after, which is noticed by a ringing sound the same as the striking of a bell. This defect is very noticeable in small rooms, and makes it very difficult to hear and speak in them, and the least noise is very irritating to a person who is of a nervous temperament. We notice this defect very plainly in the Allegheny council chamber, and especially in the select chamber.

Third, Echo.—This is a defect in very large rooms, and is produced from the same cause as resonance—throwing back the sound from the walls. It is only noticeable in very large rooms.

We have also the acoustic defects of interference and sympathetic vibration, but these do not often interfere with the acoustics of a room.

The first defect, dispersion, can easily be managed by means of ventilation. As I stated before, air is but a conductor of sound, and water is at least a seven times better conductor. Using this knowledge, all that is necessary is to force moist air in at the apex of the ceiling and carry it to within ten or twelve feet of the floor and then take it off on all sides of the room. In this manner we produce the same phenomenon that we observe in the open air before rain or when the dew is falling. We can then hear a sheep bell for a half mile or more. We also notice this phenomenon in the capitol building at Washington in two places, which are called the whispering galleries, one at the top of the dome and the other in what was the old representatives' room. In the latter we find that the air is forced through the long corridors, and, as it enters the room, it is carried up against the arches, and this, being cold marble, condenses the moisture in the air, forming a swirl of vapor which is held in the angle where the arch joins the ceiling, and this forms a regular speaking tube. Persons standing in opposite corners can converse in an ordinary tone, while those standing between cannot hear even a sound. We also find the same result in the dome, produced by a similar cause.

Second.—Resonance is produced by a reproduction of sound in the same manner as we hear the sound in the receiver of a telephone. We know that the sound does not travel for miles on the wire, but yet we are able to hear and recognize the voices of those we know. If we take the receiver apart, we find only a magnet and a very thin diaphragm of steel and iron. As the current of electricity is sent along the wire (which is the conductor), the diaphragm of the receiver that we hold to our ears vibrates and produces the very sound and tone of the transmitter spoken against. We find the same phenomenon in a room. The sounds are reproduced by the walls and ceilings, and are carried back through the air to our ears. All that is necessary is to form the walls and ceilings so that they will not reproduce, and this is a simple matter, as there are a great many materials that can be used for this purpose. All that is required is to form the walls with a soft or resilient surface, except those in close proximity to the speaker, which should be made hard and solid.

In regard to echo, we know that sound travels 1,125 feet per second, and it follows that if a man were articulating five syllables per second, it would require a sounding board to be placed 112½ feet distant so as to make a distinct echo. This is a serious defect in large rooms, as the clashing of sound is very destructive to the ability of the speaker, and it is more serious to singers, as notes are introduced at the wrong time, giving rise to false combinations and discord, producing what is called wooliness of outline. This defect is caused by making hard and solid walls at the opposite ends of the room from the speaker, which should be avoided in all cases. If a hard and solid surface is formed in close proximity to the speaker, it will intensify the sound and improve the acoustics. I have built several audience rooms in which this was clearly demonstrated, and can testify from actual experience.

In conclusion I would state that if the walls and ceilings are properly constructed in any ordinary sized audience room, the acoustics will be good and the room can be so constructed that sounds made in certain parts of the room can be heard more distinctly than if made in other parts of the room. With regard to the size and shape of the audience room, I would say that this has but little effect on the acoustics if the walls, floor and ceiling are properly constructed, and the ventilation is carefully arranged.

* Abstract from a paper read before the Association of Architects of Western Pennsylvania, by Mr. Thomas Boyd, architect.

House Painting.

BY AN EXPERIENCED PAINTER.

Much depends on the architecture of the house in deciding the style of painting. A large square house, with little enrichment or changes of surface, cannot be put into many colors, for unless the different colors are divided by divisional members of the trimming of the building, any two colors coming together would look patchy. A square building with plain sides, without any divisions, may easily be prepared for a variety of colors by having what is called in architectural parlance "bell courses" put on at different intervals over the clapboarding, so as to set on flush with the corner trimmings of the building. When set on the beveling clapboards, these will require planing on the back bottom edge, so when they are nailed over the clapboards, the front surface is perpendicular, as the window frames and corner trimmings. It is best to have these "bell courses" follow the top or bottom of windows or any projecting parts which of themselves suggest a line. One only on the surface about the middle of the sides of a building gives an opportunity to paint the main surface in two colors, and other parts can then be in stronger colors to harmonize the whole. The old or modern-fashioned houses with many gables projecting and retiring surfaces, and the surfaces being in different forms, such as shingles, upright siding, curtains, panels, etc., give an excellent chance for painting to advantage in rich colors.

I will now give some suggestions for combinations of colors. For want of illustrations by colored samples, I can only give the ideas, yet as I will give the names of the colors combined to make the tints, a painter, or one used to colors, can work from the hints given. A rich russet olive color made with raw sienna, darkened with Prussian blue and brightened with a little orange chrome for the body color; the trimming color darker, made as the first color, but omitting the orange and adding more blue and a touch of black. If there is spandrel open work in gables, or small curtains to upper windows, or any small appropriate work, all such may be painted in deep orange, made of orange chrome and Venetian red. Blinds may be rich, deep, reddish brown, made of Indian red, burnt sienna and darkened with a little black. Roofs and chimneys may be dark red, half Venetian red and Prince's metallic paint. If there is a brick foundation, it may be the same as roof, or all Venetian red. Sashes of windows may be black, or dark brown, of Indian red and black. This style will admit of small touches of red (Indian) on a few little parts, but very sparingly if at all.

These colors are a key to a long line of deep rich coloring. They may be varied with a little more orange or blue in body, with an addition of white to lighten it, or dropping the orange and adding more raw sienna. Ceilings of stoops, balconies, and, in some cases, cornices may be deep cream yellow, made with orange chrome and white. Of course the ceiling should be darkest on darkest buildings. This class of colors we will designate No. 1 for future reference.

Another style of colors which have been very popular, inclining a little more to greenish tints, is made by more white and orange, and moderated or toned down with black, with trimming color deepened with raw umber, but with less white, to prevent body from looking muddy. Humoring these shades, lighter or darker, all the various shades of sage greens may be produced. On light bodies the trimming may be dark and on dark bodies trimming may be lightest. Where there are curtains on large gables, or around the building under cornices, a third shade, lighter or darker than the body, can be used, in which case the same trimming color may be used around both colors, but it must be darker or with sufficient contrast, that the effect may not be lost on any part of the building. I would not advise using green itself for making these colors, as it will not look as soft, unless a strong green is desired, but for variety, chrome green of a good quality and black may be used for dark green blinds or trellis work. The orange, but little lighter than No. 1, may be used, and also for the blinds, leaving out the burnt sienna and substituting a little Venetian red. The roofs may be the same or redder, using more Venetian red. The floors for this as well as No. 1 may be some of the body color lightened, and more raw sienna and umber added. This last selection we will call No. 2.

It must be held in mind that the art of mixing colors of all the various tints, that are not decided or primary colors, is the toning down without destroying the richness of the color; this requires a light hand with the black or umber, especially where there is white in the color. The least over-touch makes a leaden color. The Prussian blue is also intensely strong, and must be rubbed up with a knife on a board before mixing.—*Rural New-Yorker.*

A STAIRWAY IN THE HOTEL CLUNY. A STAIRWAY IN ROUEN.

ARCHITECTURAL SUGGESTIONS.—*From Moniteur des Architectes.*

Right and Left.

Landscape painters have often found by experience that the composition looks empty if the trees are not on the left, in a subject composed of a clump of trees in the foreground, clearly detached against the extended horizon of a plain or of the sea. A recent communication of M. Delaunay to the Academy singularly extends the field of this observation by proving that the right and the left are not indifferent, either in art or in anything else. It has been observed that visitors go nearly always to the right when they enter public buildings, such as museums and libraries. Habit has perhaps some influence upon this tendency, but M. Delaunay wonders if the cause of it may not be attributed to that predominance of the left hemisphere of the brain over the right one which is one of the characteristics of superior races. As the nerves cross before their arrival, it is the left hemisphere, the more important of the two, which presides over the functions of the right side, and must incline toward the right a person who has abdicated his will and stands irresolute. If we could follow further the consequences of this principle, we might observe that modern physiology has demonstrated the independence of the functions of the two cervical hemispheres—for instance, the faculty of language is in the left hemisphere. The interest of the question would be to determine in which part resides the æsthetic faculty, and what peculiar force will be exerted by finding all the masses of a picture on the left side, and so placed in opposition to the general energies which solicit us to the right. Perhaps a mere observation would be enough to explain this apparent anomaly by making it depend upon the general law. Let us, therefore, observe that the charm of art lies especially in the suggestions which it offers. A canvas is, strictly speaking, but a net through the meshes of which our imagination plays. So the great attraction for the mind does not come from those masses of the foreground which are finished and limited, but from those vast horizons which offer space for our dreams to unfold their wings. If such be really the dominant desire of the brain, we must not wonder that the eye should seek for its satisfaction on the right.—*C. Gindriez.*

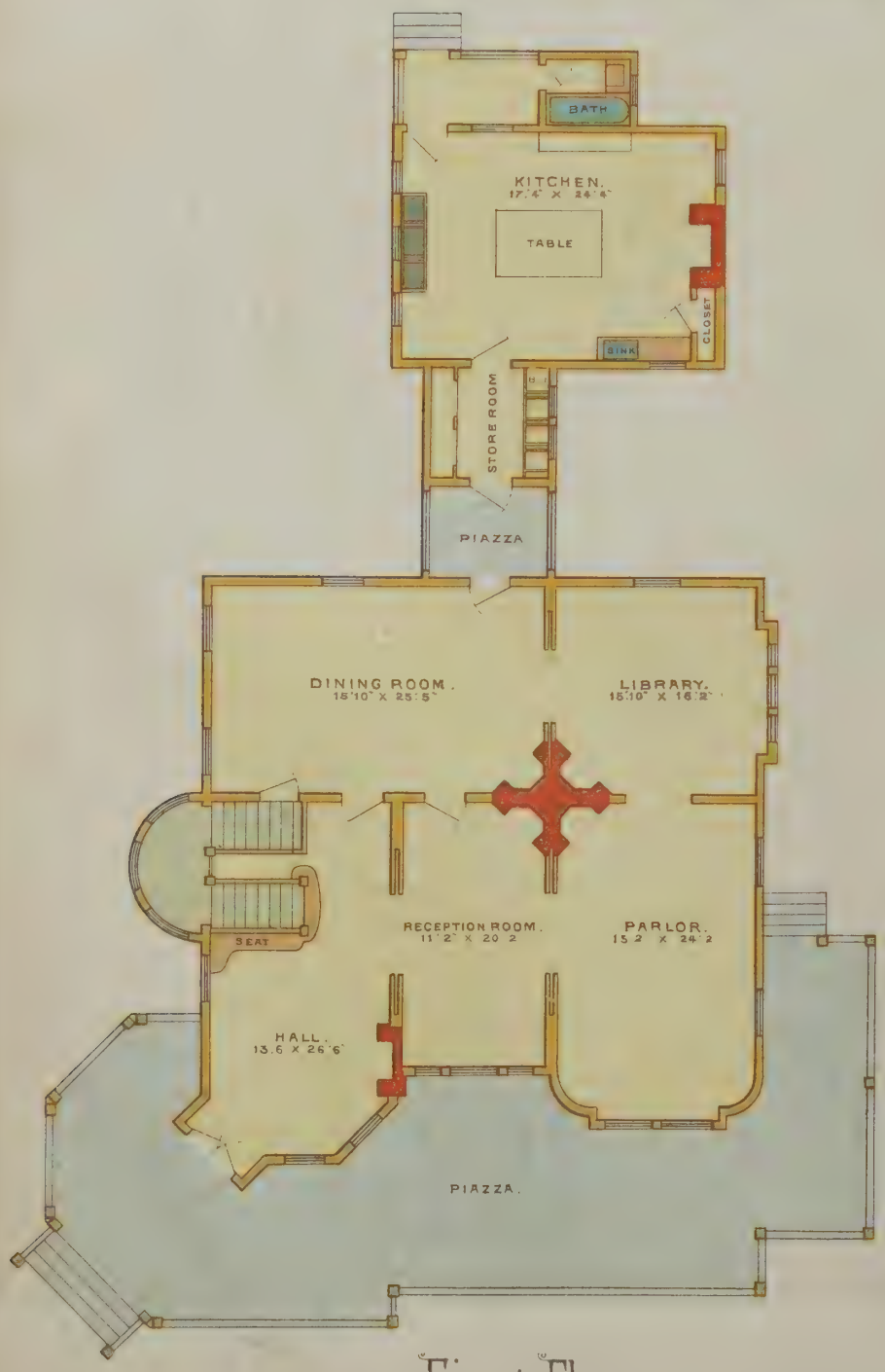
Furniture Woods.

Walnut may be on the point of regaining, to some extent, its former supremacy, but there are many users of furniture who would not like to see oak supplanted. Of course it must be as fashion dictates, regardless of the merits or demerits of either wood, but the common sense of it is that oak is one of the best furniture and finishing woods in existence. The English have known it for ages, but Americans, with all their foresight and shrewdness, are just finding it out. Oak is much cheaper than walnut, therefore furniture made of it can be sold for less money, which is something of a consideration. As compared with the somberness of walnut the color of oak is a relief to the eye, and an article made of it increases in beauty the older it becomes. The reasons are plentiful why oak should increase in popularity, instead of being forced to take a back seat.

The possibilities regarding curly redwood and burl are just beginning to be appreciated. Hardly any wood will look more richly magnificent, and instead of being a scarcity, the redwood regions of California are covered with the huge stumps from which the erratic grained lumber can be cut. It has only been of comparatively recent date that much has been done in this line, and an increasing demand has sprung up at San Francisco for the fancy lumber and veneer which rivals the finest mahogany. It is predicted, however, that many of these redwood stumps will, in the future bring as much as the trees cut from them. It will not be long before redwood veneer mills will be started, and a big industry will spring up.—*Northwestern Lumberman.*

FORESTS cover twenty-four per cent. of the entire area of Norway.

A SUBURBAN RESIDENCE.



First Floor.

Second Floor.

Detail of Step and Newel

Detail of Spindle in Stairs

Section of Base and Mould.

Detail of Hall Seat

Section of Newel.

Details of Turning for Screen

Screen across Staircase Landing

Section of Rail.

Detail of Staircase.

Section through Staircase Bay

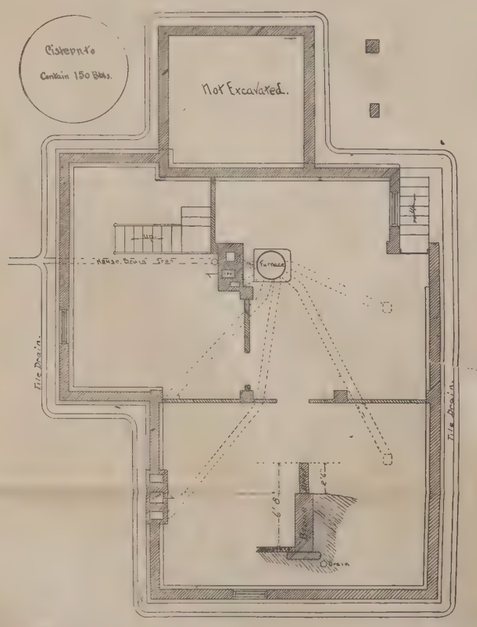
Section showing height of Stories Windows. Cornice Bell course &c.

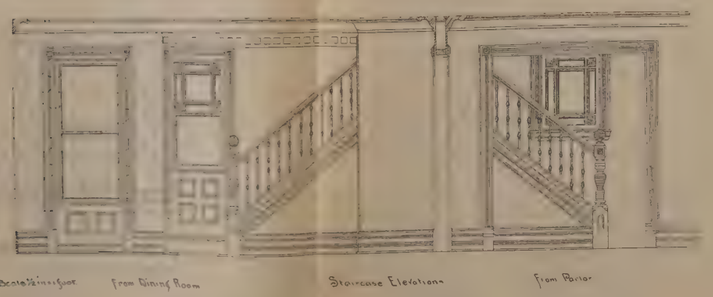
Section through Porch.

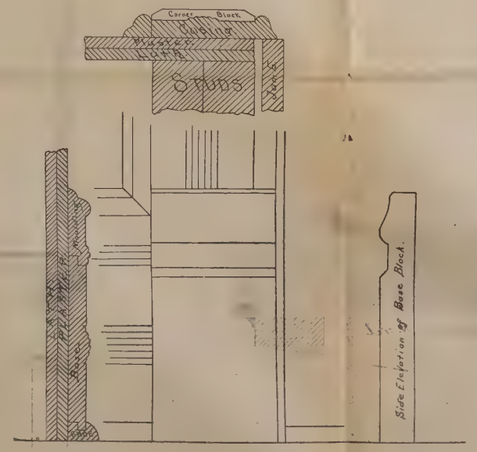
Section of Porch above Cornice Line

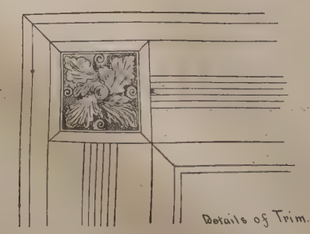
A Suburban Residence.

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for March, 1888.





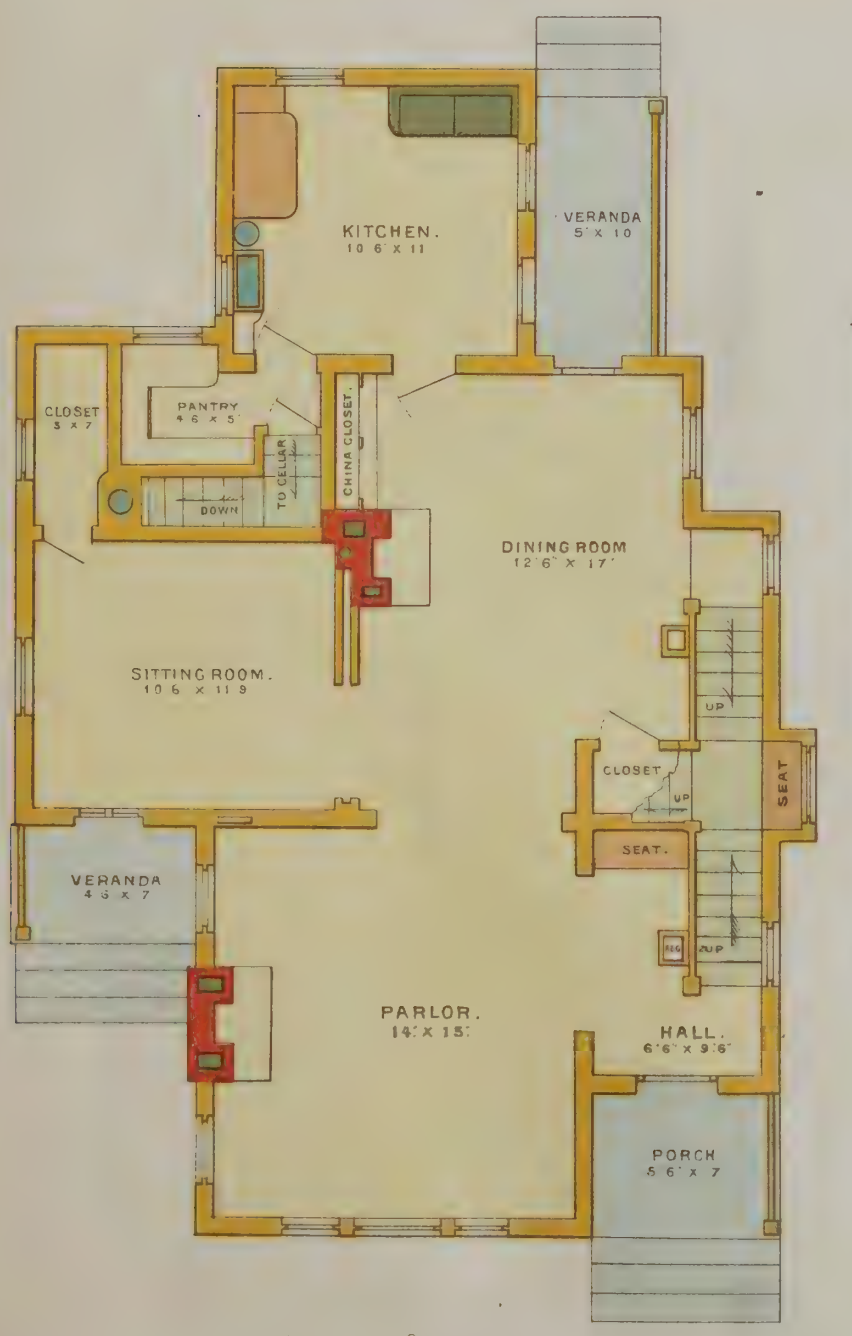




A Cottage of Moderate Cost.

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for March, 1888.

A COTTAGE OF MODERATE COST.



First Floor.

Second Floor.

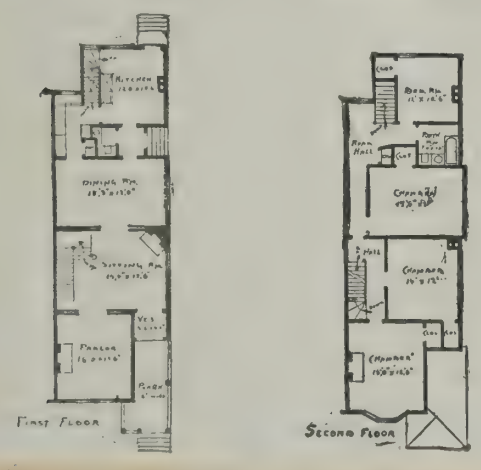
SCHUMACHER & ETTLINGER, NEW YORK.

A DOUBLE HOUSE, CLEVELAND.

Mr. Ruprect, at Cleveland, is at present building this house, which, when completed, will make two handsome and convenient dwellings. The cellar is 7 ft. high,

A DOUBLE HOUSE.

first floor 10 ft., second floor 9 ft. 6 in. It has stone foundation and slate roof; natural pine finish; wood mantels, hot and cold water throughout, and is heated



by a hot air furnace. The attics are plastered. Cost, complete, $8,000. *American Builder.*

A $3,000 HOUSE.

The illustration shows a residence recently built for Mr. F. C. Smith, of Cleveland. There is a cellar under the whole house, having a height of 7 ft. The height

A $3,000 HOUSE.

of the first floor is 9 ft. 6 in. The second floor 9 ft. It has also a good sized attic. The foundation is of stone. The interior is finished in natural pine. Stained glass

windows are placed in the bath room, hall, and attic. Stairs of oak, wood mantels, slate roof, hot air furnace, gas fixtures, etc. Water closet in the cellar. The cost of this house, says the *American Builder*, was a trifle under $3,000.

RANGE BOILER EXPLOSION.

The remarkable and unprecedented accident at the Kirby House, in Milwaukee, last December, offers an inviting subject for study by plumbers and architects.

By the explosion of the range boiler in the kitchen, havoc followed which killed one woman and seriously injured twenty other persons. The force of the explosion blew out a large section of the rear wall, and also the partition between the kitchen and dining room. The injuries were mostly caused by the falling debris.

The *Sanitary News* took immediate steps to secure a complete report of the accident. It, therefore, requested Mr. George S. Lyon, one of the best of practical plumbers, to make an investigation and send the result. The following is the report, accompanied by sketches which make it perfectly clear:

MR. LYON'S REPORT.

"Inclosed find some hurried sketches of the Kirby House, as near as I could get at it after the accident, with the limited time at my disposal. It is impossible to convey a proper conception of the tremendous havoc and complete wreck of the premises caused by the explosion. One can scarcely believe that the innocent-looking hot water boiler, even under the most extraordinary conditions, could become such a deadly and appalling destroyer of life and property.

"The kitchen floor is several feet lower than the dining room floor. The south wall of the kitchen was blown completely across the dining room, and the east wall had three stories of it blown entirely out. The wall was twelve inches brick.

"Fig. 1 shows the section of alley wall blown out, and the direct upward course taken by the boiler when it exploded. It shot up about thirty feet higher than the building, and fell back on the roof, as shown.

"Fig. 2 shows a Van range, with two fire pots, and having a 1½ in. wrought iron pipe water back with eighteen or twenty feet of pipe exposed to the heat of the fire.

"Fig. 3 shows the boiler itself. It was torn apart from the bottom where it was riveted. The dents on the head and the hole in the side were caused by its striking joists and timbers in its upward flight. It was found lying on the roof.

"Owing to the chaotic condition of the place and to the lack of time, it is impossible to get at the actual facts of the case. I will, therefore, simply give you my individual opinions as to the cause of the explosion and how it could have been avoided, based on the logic of cause and effect.

"There is no doubt in my mind that the explosion was caused by the over-accumulation of steam in the boiler, occasioned by the pipes in the cellar being frozen and the draw cocks being kept shut off. If the pipes from the boiler to the sink were clear, and the hot water cock left open, it would have been an impossibility to explode that boiler. Again, if the plumber who was working there, and who said he went down in the cellar to thaw the pipes out, had disconnected the hot water coupling on the top of the boiler, and had left it uncoupled until he had his pipes thawed, the explosion would have been avoided. There was evidently very little water in the boiler at the time of the explosion, but it is a very simple matter for a practical man, versed in the science of the plumbing trade, to explain where it went to.

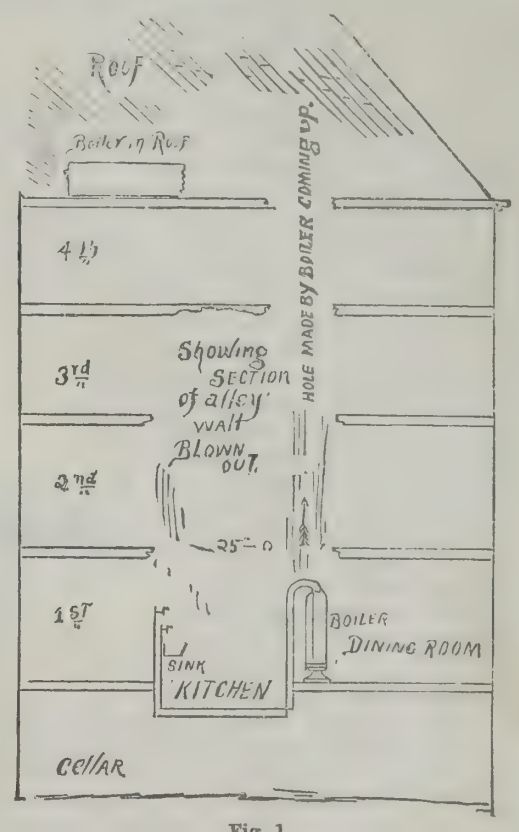


Fig. 1.

"There are several ways by which the water could have left the boiler: (1) By being drawn off by the help at the sediment bibb at the bottom of boiler for use in the kitchen and other parts of the house. This, we know, is a very common practice in hotels, and is safe enough under ordinary circumstances. (2) By being drawn off at the cold water cocks. If the cold water pipe between the boiler and the cold water cocks, the extra pressure on the boiler would force the water out of the boiler through the boiler tube, and it could be drawn at the cold water faucets. (3) By the water in boiler (supposing the plumber to have succeeded in thawing out the cold water supply) being

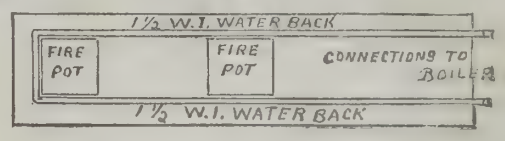


Fig. 2.—WATER BACK.

forced, by the tremendous pressure on the boiler, up through the boiler tube into the cold water supply pipe and out into the water main in the street. (4) By the steam so softening and bursting the lead supply pipe in the ground as to allow the water to escape unseen in that way. It would take but a moment under this fourth provocation to empty the boiler to within a few inches of its bottom. The little remaining water is turned rapidly into steam, with eighteen or twenty feet of 1½ inch pipe running through a Van range to heat it, and it is no mystery at all if the boiler explodes. The mystery would be if it did not explode.

"When a boiler becomes as heavily charged with steam as was this one, the mere fact of opening a faucet or the bursting of a pipe cannot save the boiler or avoid the danger, as sufficient steam cannot escape through an ordinary boiler coupling, under the circumstances, to counteract the superheating that is so rapidly taking place.

Fig. 3.

"The proper and the safest thing for a plumber to do under like conditions—and I would like them all to consider well what I am going to say—is: When you find your supply to your boiler frozen, ascertain if the circulation is clear between your stove and boiler, then disconnect the hot water coupling on top of boiler and leave it uncoupled until you have your supplies thawed out. It is safer than to open a faucet, for a faucet may get closed again before you want it to. Then your boiler and stove will be positively safe.

"The way to find out if there is a proper circulation between your stove and boiler is to place your hand on the upper pipe of the water back, that is, the pipe leading from the upper coupling of the water back

and connecting with the side coupling of the boiler. If the circulation is all right, the pipe will become first hot, then cold, alternately. If the pipe does not change its temperature, it is evident that circulation is not clear, and you had better dump your fire immediately and investigate.—*Sanitary News.*

TWO CHURCHES.

We give on this page two churches of moderate cost, one erected at Worthington, Mass The cost, built of wood, we estimate at about $4,000. Our engraving is from *Building.* The other illustration is from the *Building News*, and represents a plain, substantial structure, about eighty feet square.

A CHURCH OF MODERATE COST.

Plastering of Walls.

We will proceed to make our mortar with the best lime and clean, sharp sand. (Loam in sand is always detrimental, but clayey earths are not necessarily so.) We will use our judgment as to the proper proportions of lime and sand, as a barrel of lime varies in strength as well as in quality, owing to the size of the lumps, and the sand varies in degree of coarseness. The lime should be slaked under water and not allowed to burn. This should be mixed with an abundance of good, long hair before the sand is worked in. The hair should be thoroughly beaten before soaking, so as to break up all clots, which are a source of weakness as well as a waste of material. The sand should then be well mixed in, as the grit assists in the separation of the hair, and a thorough mixing of the sand and lime at this time is very important, as it materially assists in bringing about the first condition of hardness by having every particle of sand in contact with the lime. The longer it remains in this condition, if moist, the better for freeing the silica of the sand.

The mortar is now ready for use if the lathing is properly done. Green laths are best, for several reasons. They retain the proper width of key, which should never be less than three-eighths of an inch. While the dry lath, as soon as wet, swell, and pinch the key, thereby weakening it, shrink as the mortar dries out, and repeat it with every coat of mortar, which must affect to some extent the bond between the lath and the mortar, the green lath retain the full width of key and shrink only once, and then very gradually, and do not split at ends by nailing as the dry lath. The joints should be broken every five or seven laths, as the settling of joints or the springing of a stud makes a crack by the opening of butt ends of lath. No knotty, sappy, or unusually thin lath should be used. They can be put on quite open, as we will use our mortar well haired and not wet and slushy; and to bring about this result, we will temper the mortar twenty-four hours before using it, which will add materially to the first condition of hardness by bringing fresh particles of lime in contact with the silica of the sand, not pulled down and hashed up with water, but well tempered with the blade of the hoe, as if for immediate use. When ready for use, there will be less water in its composition, and yet it will be of proper consistency to spread. Mortar thus treated will make larger and stronger keys, being tougher, and the particles of lime and sand form a closer union, thus assisting the second or mechanical condition of hardness, as well as the chemical action of the material. Mortar, like steel, is improved by working it. This coat should just cover the lath nicely, no matter how thin, as we will draw up on the same scaffold with a good, heavy coat of brown mortar, made as the first, but without hair, and containing more sand. This we will leave with the proper application of the darby.

We draw up with brown mortar for the reason that the mortar applied to the lath requires more lime to make it adhesive to the wood and toughness to hold the key from dropping. If it is drying weather, the windows should be in, or the space covered with muslin, to insure slow and uniform drying, to assist in the third condition of hardness. At the proper time it must be well floated, not only for the purpose of leveling the surface, which is of only a secondary importance compared to the working up and compressing the mortar and bringing the particles together, as a large portion of the water has evaporated, leaving air spaces to be filled by compression. The proper time to float is when the larger portion of the water has evaporated and the moisture apparently gone; but the proper application of the float brings the moisture to the surface, leaving a nap on the surface of the wall.

Floating when dry does injury by weakening the parts when there is not moisture enough in the wall to make it adhesive again. When dry, finish with high gauged stuff. The best and least wavy surface can be produced by laying on the gauge stuff with a float and drawing up with a trowel; the wooden float cuts through an inequality on the wall, while other smooth steel trowel has a tendency to slip over it.

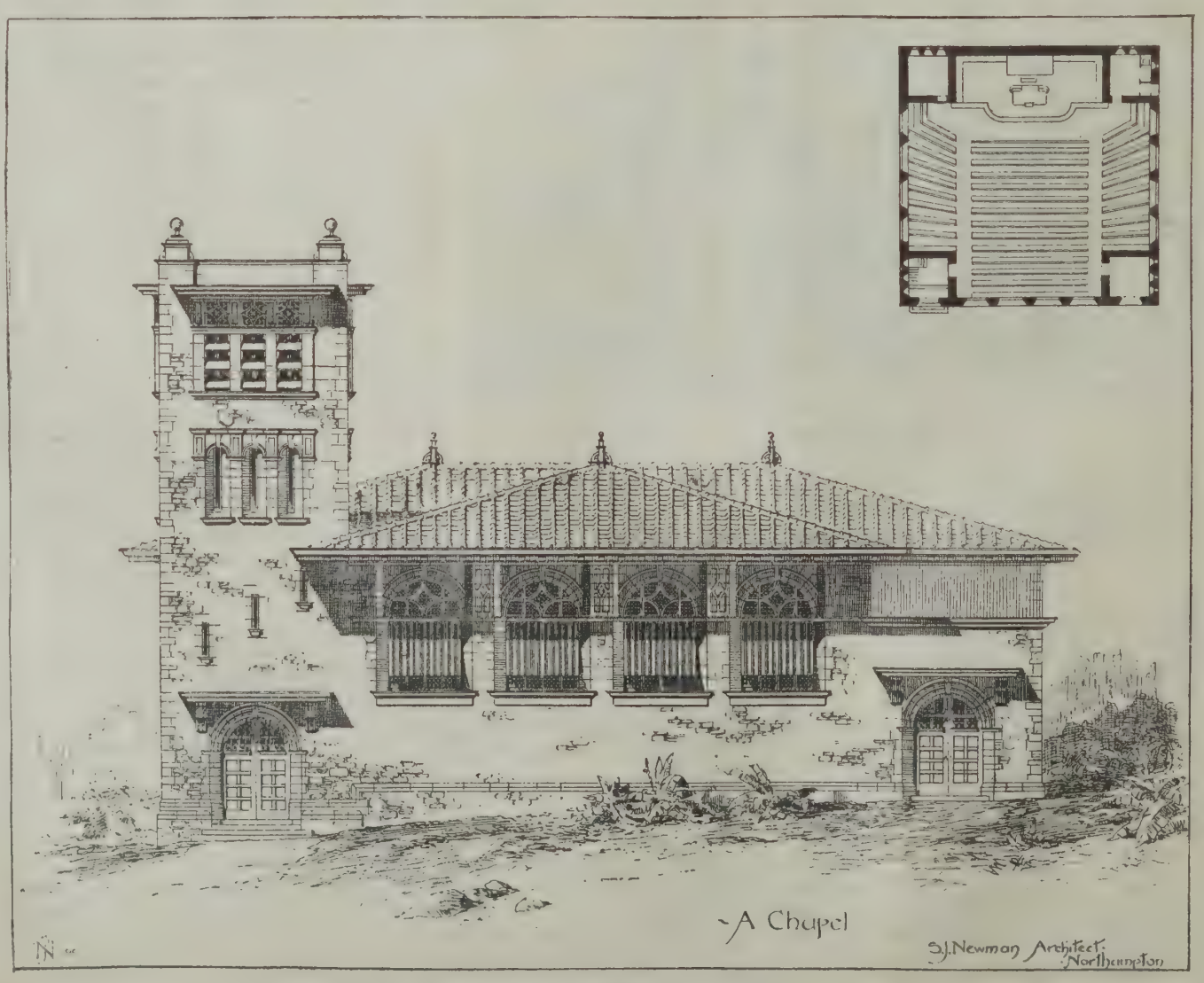
The above method is two coat work, properly speaking, calling for more labor than the usual way of putting on two coat work, and we believe that it complies better with the conditions and natural qualities of the material used than any other process in practice. But as there is a very general belief that a good job of plastering should have three coats of mortar, it will be necessary to compare the merits of the two methods as practically in use.

In three coat work the scratch coat must be necessarily thin, as there is to be a brown coat over it. If the scratch coat were to be heavy, the brown coat would weaken by overloading the wall or ceiling, as the brown coat has to be sufficiently thick to cover the irregularities of the scratching and raking up of hair and mortar in scratch coat. Therefore, the thin scratch coat is cut up and weakened by the scratching, and, being thin, it dries out rapidly, not having time for proper crystallization; and when dry, the heavy, sandy brown mortar, requiring pressure to spread, springs and enfeebles the keys more or less. The lath if dry goes through a second swelling and the brown coat dries quickly, as it has the atmosphere on one side and the lath and scratch coat on the other to absorb the moisture, and the union between the two coats is never perfect, and can be often seen separating by the jar on sides of casings, etc.

And in regard to straightness, that should be done on the joists and studs previous to lathing. It is not good practice to overload lath to straighten a wall, and there is no reason why a straight wall should be made crooked by the application of three-eighths of an inch of mortar if properly applied. It might be well to say here that grounds three-quarters thick are sufficient for lath and plaster, and every wall should have that amount on all its parts.

By the two coat process we get the proper kind of mortar on the lath for keys and adhesion to the wood, the brown coat with the proper sand for strength, which also prevents cracks, by having sufficient sand to prevent shrinkage and giving as heavy a body as the lath should be required to carry, which is all in one body, the union being perfect and a thick, moist body, which insures slow drying and, what is of great importance, a plastic body to float and compress, if taken in the proper time and no hair to collect in tufts on the surface by floating. The strength of the above wall can be greatly increased by the addition of say one barrel of plaster of Paris to the hundred yards of the first application, as this coat is where the greatest strength and adhesion is needed. There are probably sufficient glutinous scraps in the hair to retard the set of the plaster; if not, a little glue size may be added, so that no inconvenience may occur by fast setting.

By far the hardest walls we have ever seen were composed entirely of sand and plaster of Paris, about two parts of sand to one of plaster, mixed with hair and applied in the usual manner.—*J. P. McMurray.*



A CHAPEL.

A CITY RESIDENCE OF MODERATE COST.

This brick residence is situated on Washington Street near Broad Street, Newark, N. J., and is the property of Dr. Emina Edwards. Architects, T. A. Roberts & Son, Newark. The height of basement is 8′ 6″, first story 10′ 10″, second story 8′ 9″, third story 8′ 6″.

The foundation walls up to the ground level are built up with stone. The walls above the ground are built up of brick. The coal vaults are under the sidewalks in the front of the house. The main stairs from first story up to third story are of ash varnished. The trim is white pine painted.

The entire cost of this house complete is $7,675.

First Floor Plan. Second Floor Plan. Third Floor Plan.

A CITY RESIDENCE OF MODERATE COST.

Westminster Hall.

Let the spectator picture to himself the appearance which this venerable hall has presented on many occasions. Here were hung the banners taken from Charles I. at Naseby; from Charles II. at the battle of Worcester; at Preston and Dunbar; and, somewhat later, those taken at the battle of Blenheim. Here, at the upper end of the hall, Oliver Cromwell was inaugurated as Lord Protector, sitting in a robe of purple velvet lined with ermine, on a rich cloth of state, with the gold scepter in one hand, the Bible richly gilt and bossed in the other, and his sword at his side. And here, four years later, at the top of the hall fronting Palace Yard, his head was set on a pole, with the skull of Ireton on one side of it and the skull of Bradshaw on the other. Here shameless ruffians sought employment as hired witnesses, and walked openly in the hall with a straw in the shoe to denote their quality. And here the good, the great, the brave, the wise, and the abandoned have been brought to trial. Here, in the Hall of Rufus, Sir William Wallace was tried and condemned. Here, in this very hall, Sir Thomas More and the Protector Somerset were doomed to the scaffold. Here, in Henry VIII.'s reign (1517), entered the City apprentices implicated in the murders on "Evil May Day" of the aliens settled in London, each with a halter round his neck, and crying, "Mercy, gracious Lord, mercy," while Wolsey stood by, and the king, beneath his cloth of state, heard their defense and pronounced their pardon—the prisoners shouting with delight, and casting up their halters to the hall roof, "so that the king," as the chroniclers observe, "might perceive they were none of the discreetest sort." Here the notorious Earl and Countess of Somerset were tried in the reign of James I. for the murder of Sir Thomas Overbury. Here the great Earl of Strafford was condemned:

> "Each seemed to act the part he came to see,
> And none was more a looker-on than he."
> —*Denham.*

The king being present, and the Commons sitting bareheaded all the time. Here the High Court of Justice sat which condemned Charles I., the upper part of the hall hung with scarlet cloth, and the King sitting covered with the Naseby banners above his head. Here Lilly, the astrologer, who was present, saw the silver top fall from the king's staff and others heard Lady Fairfax exclaim, when her husband's name was called over, "He has more wit than to be here." Here, in the reign of James II., the seven bishops were acquitted. Here Dr. Sacheverel was tried and pronounced guilty by a majority of seventeen. Here the rebel lords of 1745—Kilmarnock, Balmerino, and Lovat—were heard and condemned. Here Lord Byron was tried for killing Mr. Chaworth, Lord Ferrers for murdering his steward, and the Duchess of Kingston, a few years later, for bigamy. Here Warren Hastings was tried, and Burke and Sheridan grew eloquent and impassioned, while senators by birth and election, and the beauty and rank of Great Britain, sat earnest spectators and listeners of the extraordinary scene. The last public trial in the hall itself was Lord Melville's, in 1806; and the last coronation dinner in the hall was that of George IV., when, for the last time probably, according to the custom maintained for ages, the king's champion (young Dymocke) rode on horseback into the hall in full armor, and threw down the gauntlet on the floor, challenging the world in a king's behalf.—*P. Cunningham.*

Notes on Bricks.

Three main points with reference to bricks have to be taken into account. (1) The power of resistance under pressure; (2) the appearance of the fracture, which should present an even texture and a fine and brilliant grain, without cavities in the interior, and neither ribbony nor stony; (3) the exterior, which should be smooth and regular, the angles and edges sharp and straight. When the size of the bricks is equal throughout the mass, it is a proof that the brick earth has been well prepared and the bricks generally well made. A brick when struck should give forth a clear, ringing sound. Good bricks are generally of a dark reddish brown color, and sometimes they show vitrified spots on the surface. It is not well, however, to depend too much on this last fact, for it is often only an indication of the amount of heat to which the brick has been subjected, while the clay of which the brick is made may be impure and ill prepared. Bad bricks are readily recognized by their reddish yellow color, but still more by the dull sound which they emit when struck; their grain being soft they crumble easily, and absorb water with avidity. A good brick should not absorb more than about one-fifteenth of its own weight of water; it should appear, and in reality be, dry. A brick that does not take up any water at all is too much burnt; the mortar adheres to it imperfectly, but it is a good conductor of heat. Such bricks may be used in damp soil and for pavements. When a brick left in water either scales or swells, it is of bad quality, and contains caustic lime A brick which, being made red hot, and then having water poured on it, does not crack, is of extraordinary and rare quality, and those which have borne the effects of moisture and dryness during two or three winters without scaling or cracking are excellent. In order to try if bricks will bear the effects of frost, let one be boiled for half an hour in a solution of sulphate of soda, saturated cold, and then suspended by a string over the vessel in which it has been boiled. In twenty-four hours the surface of the brick will be covered with small crystals; the brick is then to be immersed again in the solution until the crystals disappear, and again suspended, repeating this operation for five days, the crystals reforming after each immersion. If after this treatment a number of particles of the brick are found at the bottom of the vessel containing the solution, the bricks are incapable of supporting the effects of frost.—*D. Ramee.*

Mineral Wool.

The peculiar reason why mineral wool is so excellent a non-conductor of heat, and makes such an excellent filling material for walls, floors, and partitions, is because it contains a great quantity of air. Air is so subtile and rapid in movement when unconfined, and so slow to convey heat, except by its own motion, that it is at once the very best distributor of heat, and also the greatest barrier to its transmission, according as it has, or has not, freedom to circulate. It is not a matter of surprise that this apparently anomalous state of things is misleading and constantly giving rise to popular errors. That the dimensions of what is called an air space are entirely arbitrary no one will deny. It may have a volume of one cubic foot or it may be the smallest unit of volume into which air is divisible. The first case is classified under climatology and the second insulation, for, so long as air may circulate at all it is conveying heat from one place to another; while, if it is held in position by any medium, the heat must be conducted—not conveyed. Now, if the air-confining material is not very loose and porous, it will be found to transmit heat; and furthermore, the reduction of the percentage of volume of air, by making the material more compact, develops its capacity for conducting heat Therefore, so far as theory goes, the poorest conductor of heat is the material which contains the largest percentage of volume of air, and any other view of it is at variance with science and nature.

It is found that 192 pounds, or one cubic foot, of slag makes 192 pounds, or eleven cubic feet, of ordinary mineral wool, so that the resulting fibers encase eleven times the quantity of air that the slag did; in other words, the cubic foot before conversion contained 100 per cent. of material, and after conversion only 9 per cent., therefore the product must contain 91 per cent. of its volume of air.

AT the winter quarters of Barnum's show in Bridgeport is a long distance telephone wire connecting directly with Mr. Barnum's office at the Madison Square Garden in New York. While the recent poultry show was in progress in the Garden, the roosters raised such a racket by crowing that it was almost impossible for the New York clerks to hear at their end of the line, especially in the morning. The crowing could be distinctly heard in Bridgeport, and the Shanghai's piping screech was fully as distinguishable as the crow of the biggest rooster in the show.

HEATING AND VENTILATION.

In the history of architecture there never has been a time when the problems of heating and ventilating dwellings claimed as thorough a consideration as they do now. In the matter of heating, that which is required is to have, if possible, every part of the dwelling comfortably warm. For this to be done, it is necessary to prevent the entrance of out door air before it is warmed. Care is, therefore, taken to close all crevices around doors and windows, or through the outer walls of the house, by which the cold outside air can gain admittance into the dwelling. Double sash, weather strips, sheathing paper, and other devices are called into service to exclude the wintry winds. But, in doing this, while great benefit results in maintaining a comfortable temperature in the house, a far more serious harm, also, results from the fact that the excluded air contains the vital principle that alone can confer upon the inmates of the dwelling the most important blessings of life, viz., health and strength and physical comfort.

The problems above referred to thus are complicated. It is impossible to keep warm unless the outside *cold* air is excluded. It is impossible to keep well, or even to live, if the outside air is prevented from having a free circulation in the house.

Nor is this all. Not alone must the pure, out door air be given free admission to the house, but, to maintain the health of the inmates, the air that has gained admission and has been vitiated by respiration, by exhalations, or by the effects of combustion in the rooms, must be removed to give place to the fresh supply.

How shall this be done? There is one method by which, it is obvious, it may be done. If an arrangement were made by which out door air *previously warmed* to a temperature higher than that of the breath were *continuously* admitted, and at the same time an equal amount of the cooler air, near the floor, were continuously exhausted, the rooms would be constantly supplied with warm and pure air. How can this be effected at a cost not very great? We do not say *too* great, for scarcely any cost can be too great that insures health and comfort. But this desirable condition of the inside air can be and is obtained with little, if any, greater expense than is involved in ordinary methods of heating.

It may be obtained in rooms that are supplied with a generous current of pure, warm air from a hot air furnace, and that have in them also an exhauster of the air near the floor, which may be in the form of an ordinary open grate with its glowing fire.

This is, however, expensive, as it involves two fires, which use a large amount of fuel, and, during fall and spring produce an unnecessary and frequently an annoying excess of heat.

Within the last ten years a *combination* of the grate and furnace has been introduced, and is now extensively employed, the most practical form of which is represented in the illustration on this page (one of nearly a hundred designs in which it is made). This is a fireplace furnace, manufactured by Edwin A. Jackson & Bro., of New York City, and is called the Jackson ventilating grate. It, like any other furnace, has a cold air supply from an out door source. Air thus admitted into chambers surrounding the fire on every side, excepting in front, becomes heated therein, and is conveyed into the room through a register in the frieze of the grate, or, at will, by a pipe running up the smoke flue to a room on the floor above the grate Thus are heated and ventilated by this combined action of the grate and furnace two or more large rooms

THE JACKSON VENTILATING GRATE.

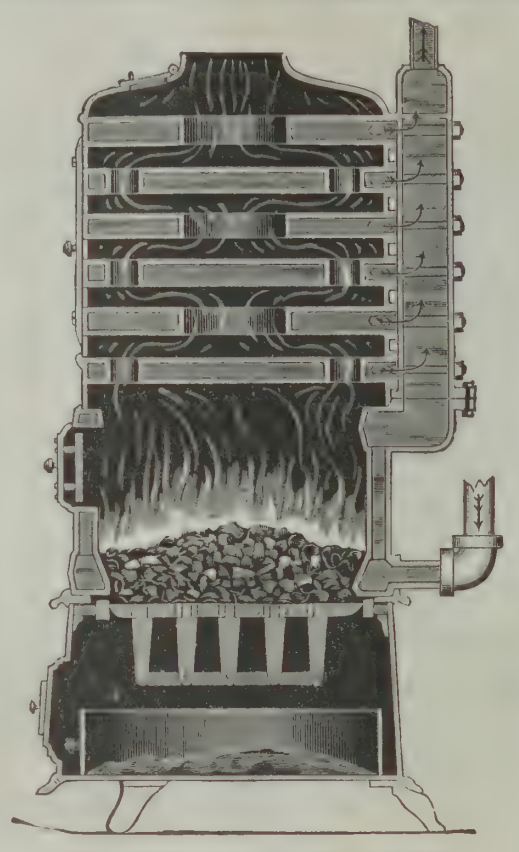
on the same or on different floors in any latitude of the United States with no more expenditure of fuel than an ordinary grate requires. Thus, also, rooms on the north or west side of houses, which the ordinary furnace usually fails to heat in severe winter weather, are made comfortable, since the ventilating grate can be set in the fireplaces of the most exposed rooms and the heat be generated where it is most required.

London has a sanitary inspection company that for a fixed fee inspects your plumbing, and tells you whether you are breathing sewer gas or ordinary air.

THE SPENCE HOT WATER HEATER.

We illustrate in the cut accompanying this article the Spence hot water heater. As the ideas of builders become more advanced and the tendency to the production of first class houses increases, the heating apparatus acquires more importance.

The hot water system, among others, has received much attention. A skillfully constructed boiler is, above all, a necessity for its application. Such a one



THE SPENCE HOT WATER HEATER.

we here present to our readers. When it is in use, the air of a dwelling is most hygienically treated. It is warmed to an agreeable degree by contact with hot water pipes. These are so hot as to effect every economy in warming the air. The large heating surface conduces to economy in fuel, and the body of water insures a steady working of the apparatus.

But, as stated, all the arrangements will be in vain if the original source of heat is not of proper construction. In the Spence sectional boiler we find what is in every sense a reliable and economical heater. Its leading features are very clearly presented in the cut.

The walls of the fire box, nearly down to the level of the grate, are composed of the boiler itself. Comparing it to a locomotive boiler, we should call this portion the legs of the boiler. A short distance below the bottom of the legs the grate is set. The ashes, therefore, are, to a great extent, kept out of contact with the heating surfaces. This tends to prevent corrosive action. Above the fire chamber the structure is built up of horizontal box-like sections. These are placed one on top of the other until a sufficient water capacity is attained. They are held together by short stud connections. This marks an important departure from the ordinary practice in sectional boilers. Frequently, to connect their parts, long bolts are used, which, passing through the sections, receive a nut to lock all together.

Such practice is very defective. The long wrought iron bolt is liable to rust and deteriorate, and on account especially of its length, elongates and contracts under changes of temperature. The stud fastenings used on the Spence boiler are entirely secure, do not corrode, and are free from liability to changes in length. They are removed from all action of the fire or gases.

A section represents a short drum. Through each of them one or more apertures are carried, through which the products of combustion pass. These openings are so proportioned that their area is no larger than that of the entrance to the chimney or escape flue. This prevents the gases from passing so rapidly through the boiler as to waste heat. The openings through the sections are so placed also as to cause the hot gases to take a tortuous course, thus doing their work very effectively.

Two other great factors of economy are reached. The first is perfect circulation of the water. Each section has free communication with a common water port or header. The next factor is represented by the large extent of horizontal heating surface. Each section exposes a large flat area to the flames, and it is a recognized law in boiler practice that the heating value of a flat surface is far superior to that of a vertical one.

The construction of the grate allows for liberal air space, insuring perfect combustion. It removes ashes as well from the edges as from the center when it is shaken down.

There are few joints requiring packing, and these are the furthest from the fire, so that no complaints of leaking joints are received.

The National Hot Water Heating Co., 191 Fort Hill Square, Boston, are the proprietors of this apparatus, and will be glad to answer all queries relative to it and its adjuncts in the line of warming houses.

The Testing of Stains.

A good stain for exterior use should be very finely ground in oil, and should contain no kerosene or other useless adulteration.

To detect a stain which contains the latter cheapener, allow a can to remain open for a week, when the characteristic odor of kerosene is detected.

To test for fineness, stir the stain thoroughly and allow it to settle for an hour. If the color has settled more than an inch or two, the material has not been ground at all, but merely stirred into the vehicle. Such a liquid should be avoided, for it does not give a staining effect, but looks granular and uneven on any except the coarest and roughest surfaces.

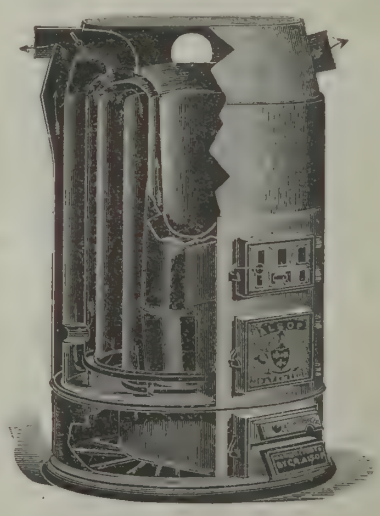
THE ALSOP FURNACE.

The principle of return flues for utilization of the products of combustion, to thereby obtain economy of fuel, is well carried out in the furnace here illustrated. The gases from the furnace pass from the upper part of the combustion chamber directly to the radiator. The latter thereby is constituted virtually a part of the combustion chamber. From the radiator the products of combustion are not carried directly to the chimney, but a further and important use is made of them. They are caused to ascend through an annular space between the outer galvanized iron jacket of the furnace and the inner smoke jacket. This makes a radiator of the smoke jacket. It also protects the heated air from the cooling effects of the atmosphere of the cellar. The plan is analogous to that adopted by steam engineers in causing steam to circulate around the cylinder of an engine. The furnace is jacketed with hot gases as the steam cylinder in question is with steam.

The air supply is treated in somewhat the same way. It enters the furnace close to the fire pot, which has the hottest heating surface. Alongside of this and the combustion chamber, it rises up to the top of the furnace. Here it turns and passes down to the bottom of the radiator, a distance equal to that which it has passed over in its ascent. Making a second turn at the bottom of the radiator, it eventually rises to the dome, whence it passes to the register flues.

The hot air chamber, as already stated, is protected from cooling by the gas jacket or hot space surrounding the furnace. This produces the same effects with regard to economy of fuel as are due to the ordinary brick setting used in stationary furnaces. The Alsop furnace combines the advantages of a portable furnace with the economy of a brick-set furnace.

In actual use, it is claimed that the smoke pipe of this furnace will be cooler than the register pipes, showing how little of the heat goes up the chimney, only enough passing therein to insure a good draught. This result is obtained without opening any check draught or damper, and when no cold air is allowed to enter the chimney. Its delivery through the hot air pipes leading to the rooms was found to be very rapid. A velocity of air current of 580 feet per minute was obtained at the register in a competitive trial.



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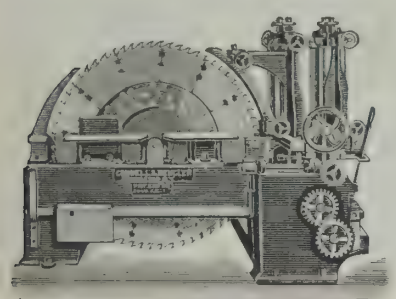

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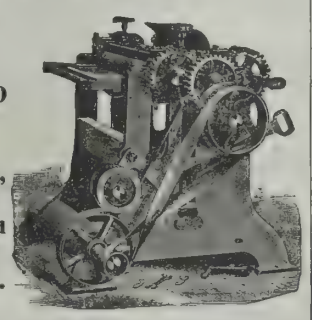

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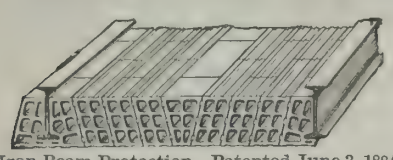

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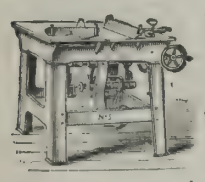

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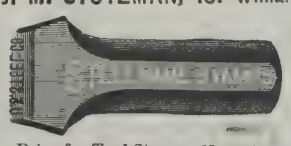

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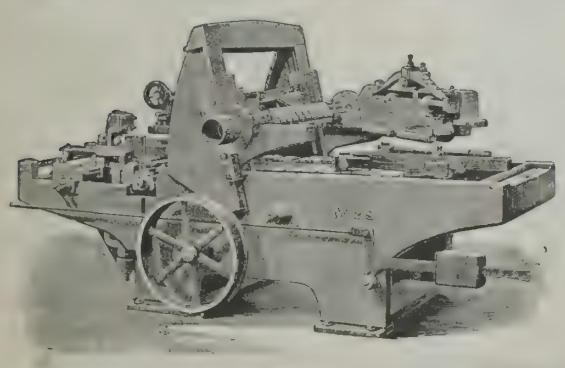

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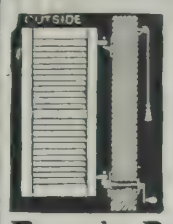

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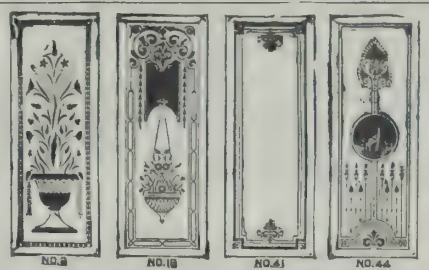

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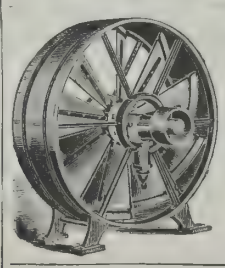

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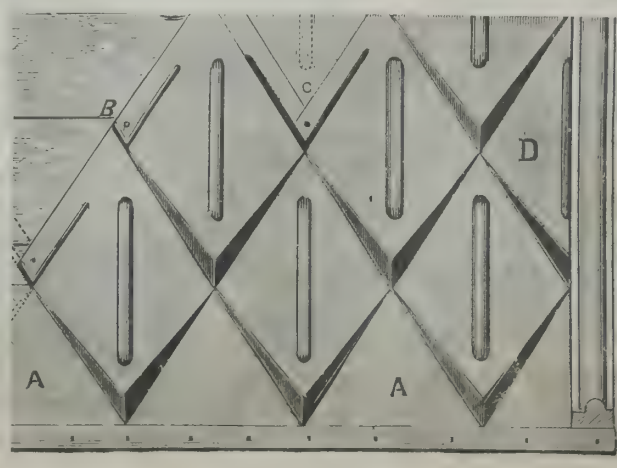

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. J. C. asks the best coating or covering to prevent water pipes from freezing. A. Heavy hair felt and mineral wool covering, boxed, or boxing and filling with sawdust, hay, or straw, are all suitable for preventing freezing. The size of the box should be made suitable to the intensity of exposure; ¾ inch or ¾ inch water pipe should have from 3 to 5 inches of space all around filled with packing where exposed to cold winds.

(2) H. F. B.—The rubber for band saw wheels should be made in rings and stretched on. You may also wind the rubber in thin strips around the groove with rubber cement. The rubber should be what is called pure gum in the trade. Gum and cement can be procured through the rubber trade. After winding and cementing the strips as a solid piece, and tying the end down, the wheel should be placed in a warm place to dry, for a day or two. Leather is sometimes used when rubber cannot be readily procured. You cannot glue rubber to stand.

(3) D. & H. ask the process and how to make solution used to color bronze hinges, locks, etc., a rich brown, the color of confectioner's chocolate. A. For a dipping brown, use to 1 pint of water 5 drachms perchloride of iron. The articles must be made perfectly clean and dipped in the hot solution until the required color is obtained; then dipped in clean hot water, dried, and lacquered. If only a varnish is required, use clear shellac varnish colored with dragon's blood, gum, and burnt umber.

(4) G. V.—For painting tin roofs use red oxide of iron (Prince's metallic paint) mixed with boiled linseed oil. Temper the color with lampblack if a darker color is required, or with white lead for a lighter color. If necessary to facilitate spreading with the brush, add a little spirits turpentine. This paint is tough, holds well, and if neatly done looks well. Coal tar paints are sometimes used, but are liable to chip in cold weather.

(5) R. R. W. writes: I wish to move a large building over ice which freezes from 2 to 3½ feet. Will it be safe? A. Ice 8 inches thick will support heavy wagons and artillery. The crushing strength of ice varies from 327 to 1,000 pounds per square inch. At the lowest figures this is 23 tons to a square foot. This does not represent the bearing power of the ice covering water, in which case it becomes elastic under pressure, and may give way without crushing. A building of moderate weight may readily be moved over ice 3 feet thick, if properly set on runners of large bearing, and moved along at a fair pace. The only difficulty in such work arises from suspension of the work, when the weight might press the ice down in the vicinity of the building, and cause cracks which would flood the depressed surface, and possibly cause disaster.

(*Continued on page* x.)

Building Plans and Specifications.

In connection with the publication of the Building Edition of the Scientific American, Messrs. Munn & Co. furnish Plans and Specifications for Buildings of every kind, including Public Buildings, Churches, Schools, Stores, Dwellings, Carriage Houses, Barns, etc. In this work they are assisted by able and experienced architects.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address

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Any person having a new invention may, without charge, consult MUNN & CO., Scientific American Office, 361 Broadway, New York, for advice how to obtain a Patent or Caveat. Our Hand Book of Instructions relating to Patents sent free.

Leather Link Belting is the most reliable for swift running machinery. For particulars write Chas. A. Schieren & Co., 47 Ferry Street, New York.

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We have been using one of your 4½ inch Link Belts on quarter turn for the last four months. It has done its work in a most satisfactory manner, and we take pleasure in recommending it as the most perfect quarter turn belt we have ever used. Yours very truly,
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For Steam Heating—the Dunning Patent Wrought Iron Boiler. Over 13,500 in use. Manufactured by New York Central Iron Works, Geneva, N. Y., U. S. A.

A patent for $100. Copy, 10 c. L. box 120, Concordia, Kan.

"The Improved Greene Engine." Steam closing mechanism. *Sole* builders, Providence, R. I., Steam Engine Co.

Small boat eng. and b., $90. Louis Sahm, Indls., Ind.

Wanted—A thorough mechanic, well posted in the manufacture of locks and of builders' hardware in all its branches, and capable of taking charge of a large factory as general foreman. State past experiences, etc. Address "Manufacturer," P. O. box 773, New York.

Patent button fastener, No. 376,497, for sale, or placed on royalty. Address A. L. Winn, Hillsboro, Ark.

Wanted—A first class traveling salesman, with experience in selling machinery. Apply by letter to "H.," box 773, New York.

Don't figure percentage and make mistakes. Send for circular. Ladd's Discount Book, 35 Chambers St., New York.

The Diamond Prospecting Co., 22 W. Lake St., Chicago, Ill., general agents for the Sullivan diamond prospecting drills.

Parties requiring milling machine or screw machine work furnished in large or small quantities, will please write to the manufacturers, E. E. Garvin & Co., 139, 141, 143 Center St., New York City.

For House Pumping.—For sale cheap—A 5" Rider air engine, with 1¾" pump. But little used. H. N. M., P. O. box 773, New York.

Foree Bain, 76 Market St., Chicago, designer and constructor. Electrical apparatus, fine and special machinery, etc.

For Sale—A Springfield gas machine, 600 light, with all the appurtenances. In good order. Apply to Secretary of the Northern Liberty Market Co., Washington, D. C.

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Burnham's New Improved Turbine. Sold at cost of manufacturing and advertising. Address York, Pa.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the Scientific American Supplement sent to them free. The Supplement contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Curtis Pressure Regulator and Steam Trap. See p. 77.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Multiple spindle drills, driven by endless belts, with adjustable tightener. New, novel, cheap. Dwight Slate Mch. Co., Hartford, Conn.

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IMPROVEMENTS OF PRAIRIE ROADS and Streets. By T. J. Nicholl, C.E. Economical and Practical Suggestions, with six figures; on Width, Drainage, Ditching, Rolling Soils, Culverts, and Cost. How to Keep in Repair. Laying out the Streets of a Town, with Cost and Repairs needed, etc. SUPPLEMENT 150. Price 10 cents.

Notes and Queries.

(*Continued from page* vi.)

(6) S. Z. says: Will you please give a good way of making black mortar for pressed brick work? Also best process of tuck pointing. By giving this information you will oblige a new subscriber. A. Ivory black is a good coloring for black mortar for brick work. Point joints with pointing trowel with strong cement mortar and finish with tucker.

(7) C. H. S. asks (1) how to make a strong joint with glue. A. Use new glue, and in applying first fill the pores of the wood with thin glue and let it dry; then clean off, and glue it at the joint with strong glue. 2. How to make a good hard oil finish. A. Take of linseed oil 1 pint, rectified spirits 4 ounces, oil of turpentine ½ pint, powdered resin 1½ ounces, rose pink ¼ ounce; mix. 3. A good cheap wood filler A. Boiled linseed oil 1 quart, turpentine 3 quarts, corn starch 5 pounds, japan 1 quart, calcined magnesia 2 ounces; mix thoroughly. You can buy better prepared fillers than you can make.

(8) E. T. S. asks: 1. How can I give pine wood an ebony finish? A. Use the following: Dissolve 4 ounces shellac with 2 ounces borax in ½ gallon water. Boil until a perfect solution is obtained, then add ½ ounce glycerine, after which add sufficient aniline black (soluble in water), and it is ready for use. 2 How to crystallize glass so that it will not wash off. I have used salts and sour beer, but the least moisture destroys it. A. After you have allowed your salts to crystallize, thin coat the glass with a light coat of varnish. Otherwise you must use the sand blast or some permanent method. 3. How to transfer any lithograph or printed picture of any kind on glass, so that it will be visible from both sides, and will last a long time. A. The process consists essentially in giving the warmed glass an even coating of balsam or negative varnish. Place the face of the print on the surface thus prepared, when the varnish is partly dry, but still tacky. Smooth it out and let it stand in a cool place until the varnish sets. Then apply water, and with a soft piece of gum rubber, or the finger tips, rub off the paper so as to leave the image on the varnished glass.

(9) N. B. D. asks: 1. How many gear wheels would make a good set for ordinary use on a small Barnes lathe, which I wish to convert from a hand feed to an automatic screw cutting feed? How many teeth should the several wheels contain? A. For a small lathe for amateur work the screw should be 10 threads to an inch. If the screw has a left hand thread, it will require a 4 gear train. If a right hand thread, it will require a 5 gear train. The left hand screw and 5 gear train gives the best control of the distance between the centers of spindle and screw. The change can be made movable on a radius bar to accommodate the varying distance made by the different sizes of thread gear. The teeth should be about three-sixteenths inch pitch. The spindle, change gear, and inside stud gear may be 36 teeth, then for outside stud gear and screw gear for—

	Stud gear.	Screw gear.
10 threads.	32	32 teeth.
12 "	40	48
14 "	40	56
16 "	20	32
18 "	20	36
20 "	20	40
22 "	20	44
24 "	20	48
26 "	20	52
28 "	20	56
30 "	20	60

2. Which would be the most economical and practical form of rotary engine—one of large diameter and short through shaft, or small diameter and greater length? Would not the first develop greater power at slower speed? Theoretically, the rotary engine would seem to be the best form of steam motor, as there are no dead centers and motion is continuous in one direction. Since steam can also be used expansively in this form of engine, what are the objections that prevent its more general use? A. No form of rotary engine has as yet been found to be economical when the factors of wear and waste of steam are considered. This is probably the secret of their scarcity in the list of steam engines on the market for practical and durable work. The large diameter rotary has narrow disks sweeping over large surfaces that are difficult to adjust to prevent leakage. The small diameter rotaries are the class that have mostly been adopted by builders of such engines.

Classified Index of Advertisements Published in the Present Number of the Scientific American, Architects and Builders Edition.

CLASSIFIED ADVERTISEMENTS.—Continued from page xi.

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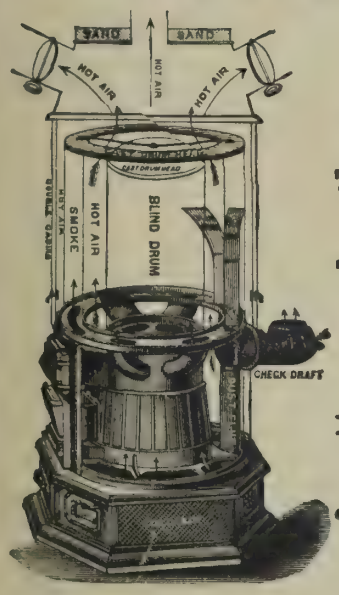

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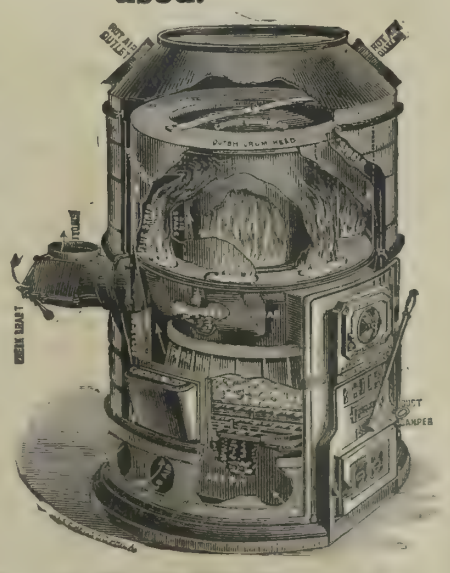
Base imitations, avoiding our Patents, exist.

Do not fail to specify the NOVELTY and be sure you get it.



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For Churches & Dwellings

Antique and Mosaic Work. Designs and Estimates on application.

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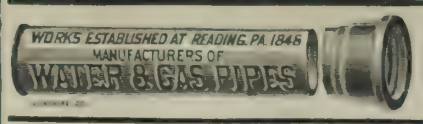

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BRASS LAMPS FOR CHURCHES.
BRASS WORK FOR CHURCH ALTARS.
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THE Dunning Boiler, Self-Feeding, is the best for Low Pressure Steam Heating, and insures a warm house night and day. Free from Carbonic Acid Gas and Smoke. Made in eleven sizes, suitable to heat the Smallest Cottage to the Largest Business Block, in five different styles:

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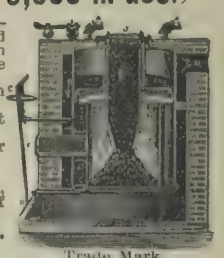
LOCK BOX 40. *Send for New Illustrated Catalogue.*



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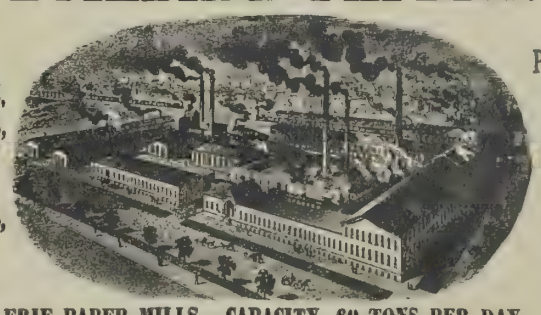

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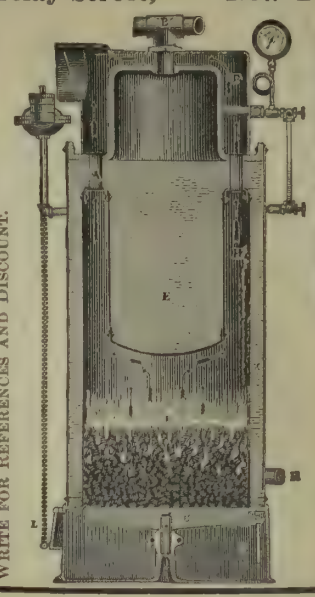

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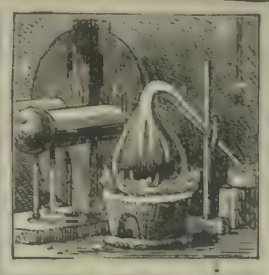

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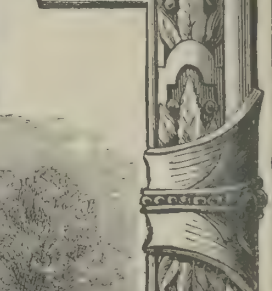

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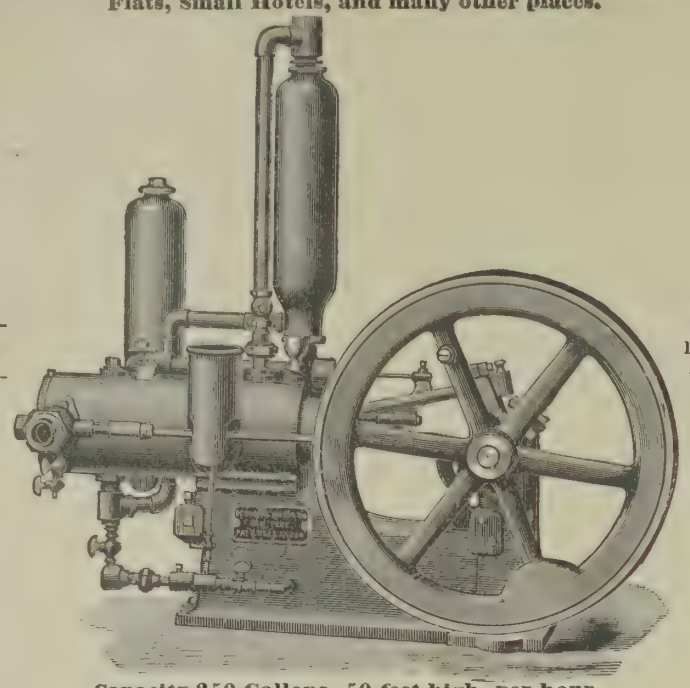

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No. 7. One-Half Horse, 600 Gallons, 50 feet High, per Hour.
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Our Gas Engines will work satisfactorily when attached to Gasoline Machines.

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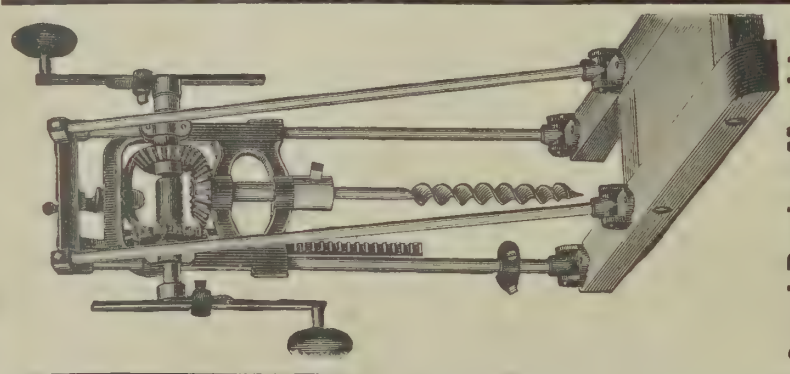

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FEED WATER HEATER

With Seamless Brass Tubes and the most recent improvements.

Specially adapted for utilizing the exhaust steam of

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We guarantee one square foot of heating surface per horse power.

We can give reference from Heaters already in operation under the same conditions, giving the best of satisfaction.

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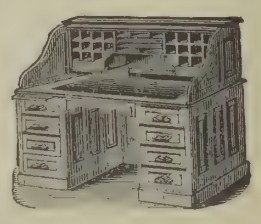

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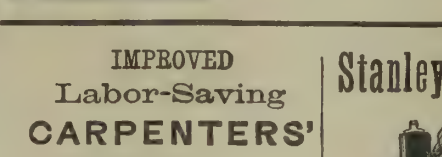

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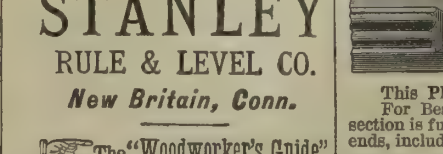

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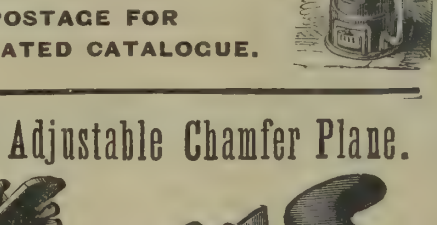

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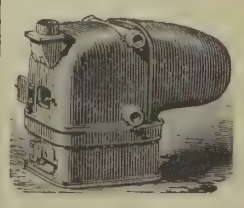

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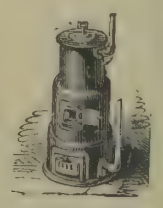

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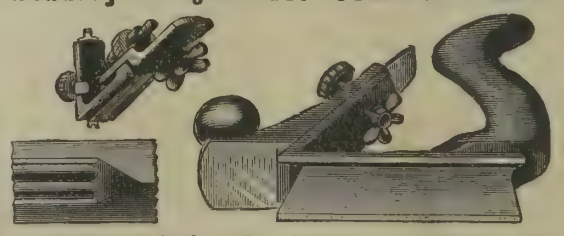

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THE CALDWELL HOTEL AT BIRMINGHAM, ALA.—EDOUARD SIDEL, ARCHITECT.

[For description see page 68.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

No. 361 BROADWAY, NEW YORK.

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NEW YORK, APRIL, 1888.

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CONTENTS

Of the April number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

A RESIDENCE OF MODERATE COST.

One of our colored plates for the present month is entitled as above. It represents a comfortable and elegant dwelling. We give herewith the floor plans. The estimated cost is $10,250.

The front, not including bay, measures 45′; the side, not including piazzas, 61′; for size of rooms, see floor plans; height of cellar, 7′; first story, 9′ 6″; second story, 9′.

The foundation is of stone and brick; first story, clapboarded; second story, gables; tower and roof, shingled.

The house has fine, large rooms, extra large vestibule and entrance hall, a wide staircase, set so far back that, by opening the sliding doors connecting the parlor and sitting room, the entire front of the house may be converted into one apartment, which is a desirable feature. There is a comfortable and attractive veranda or balcony on three sides of the house, which, while furnishing needed shade, does not exclude the sunshine from the adjoining rooms. Large and well lighted chambers on the second floor and attic story. The numerous and liberal size of the closets is calculated to give satisfaction to the lady of the house. The arrangement of the stairs is such that, by closing the door between butler's pantry and dining room and the one connecting rear and front hall on second floor, the front part of the house may be shut off entirely from the kitchen and attic. The principal rooms have fireplaces.

A COTTAGE FOR $1,900.

One of our colored plates for this month shows a neat cottage for nineteen hundred dollars. Herewith we give the floor plans. The house has a front of 24′ 6″ extreme; side 28′, not including piazza or back pantry.

For size of rooms see floor plans.

Height of cellar 6′ 8″. First and second stories, 8′ 6″.

Materials.—Foundation, brick. First and second stories, novelty siding between first and second story windows. Roof and gables shingled. The inside, including the ceilings, is sheathed with patent sheathing lath. This is finished with one heavy coat of plaster. Cost complete, $1,900.

The parlor, dining room, and front hall open into each other. A stove may be placed in parlor, dining room, and one chamber if needed. Large pantry off dining room, and outside entry to kitchen. Good sized closet in kitchen. Inside cellar way to cellar. The front hall and stairs give a good appearance. The front stairs can also be somewhat private by hanging curtains.

The stairs to attic are over main stairs. There can be finished in attic two good rooms. There is a convenient bath located in second story. The whole house is well supplied with large closets conveniently arranged. This plan can be reasonably enlarged without in any way affecting the artistic appearance of the elevations.

THE CALDWELL HOTEL AT BIRMINGHAM, ALA.

We give on our first page a perspective view of this noble structure, the design of Edouard Sidel, architect, of the above place, and erected under his superintendence.

The hotel, when finished, will be, without any doubt, one of the finest structures not alone in the State of Alabama, but of the Southern States. The thirty feet wide staircase, entirely fireproof; the grand staircase, the dining hall and parlors, are of large dimensions, seldom found in a building put up by a stock company. The building will easily accommodate 300 guests. It is provided with all the modern improvements to be found in the best hotels in the country. The building is six stories high, besides the cellar. Its construction is very massive, all the outside being of Philadelphia pressed brick, terra cotta, and iron and stone. It will be completed by July next, and will cost, unfurnished, over $300,000.

Dr. H. M. Caldwell, one of the most popular men of the State, and president of the Elyton Land Co., in Birmingham, is the president, and Capt. Joseph F. Johnston the secretary and treasurer of the hotel company.

Trees for Marsh and Mountain.

The aspen poplar (Populus tremula) is one of our hardiest native trees, and it is not only hardy, but likewise highly ornamental and capable of reproducing itself on all classes of soil and aspects—from the waterlogged marsh in its native glens up to the top of some of our rugged hills. In bare, rocky, exposed situations the aspen poplar does not attain a large size, but from its conspicuous position in such places the smallest trees can be seen to advantage, and when these are clothed with their pretty golden-colored foliage in autumn they are highly attractive, and when mixed with other trees of a somber character their character is very marked. In its native wilds the best and largest trees are to be found on damp, alluvial soil well mixed with organic matter, and I have likewise found trees of a useful size growing in boggy marsh ground that contained a considerable quantity of stagnant water. In order, however, to grow the tree to the best advantage in such places, it is better to have the ground drained, and although this will entail a little extra expense at the time of formation, yet the quicker growth and larger size of trees produced in this way will far outweigh the extra outlay. The tree may also be grown for profit and utility on ground of ordinary texture, especially such as rests upon a cool clay subsoil of a damp character, and which has proved unsuitable for cultivation. On such a soil I have grown some fine trees of this species which proved both useful and ornamental.

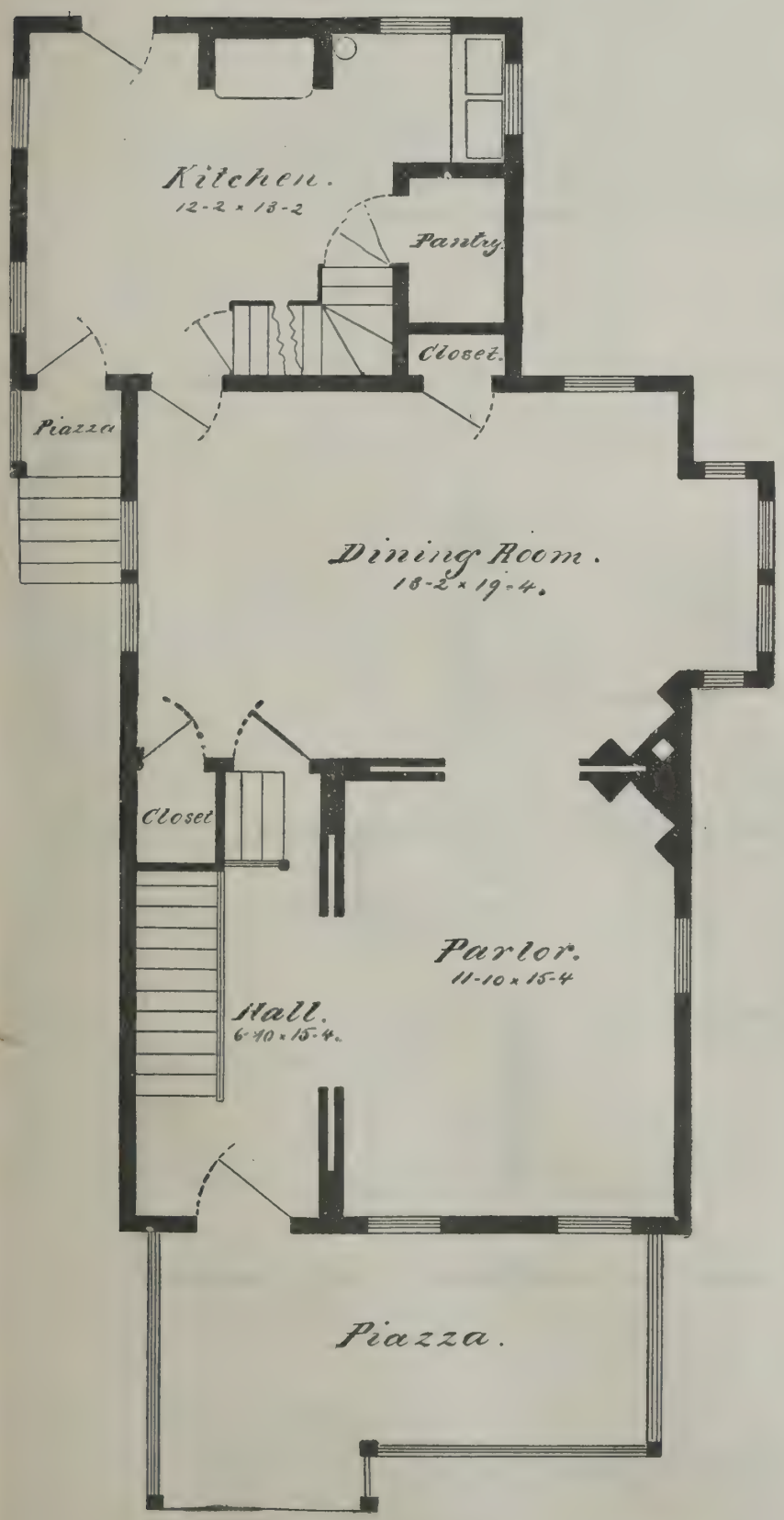
When cutting this tree in the natural forest I found many of the trees growing upon loose shingle and dry sandy soil to be affected with heart rot; and although the external appearance of some of the trees at first sight betokened a healthy interior, yet, when cut, in many cases the trunk was but a mere shell. Although I had no means of knowing the age of these trees, yet it is not improbable that had they been cut at an earlier stage of their growth, the stems would have been found to be less affected by this disease. The planter, however, had better not plant this tree on dry, shingly soil and bare rocky places for profit, as I have found young as well as old trees affected with rot in such positions. On the other hand, where profit is only a matter of secondary consideration, it may be planted on all classes of soil and situations in order to give variety and improve the beauty of the scenery.

The timber is used for a variety of purposes, and when sound and of good quality commands a ready sale, at prices ranging from 4d. up to 8d. per cubic foot. I have likewise sometimes sold it at 10s. per ton. Cuttings made from twigs and branches of this tree refuse to grow, but cuttings made from the roots and inserted in sandy soil root freely and make fine trees. In the natural forest the tree reproduces itself from seed, which is ripe in early summer. The seeds being surrounded by a soft, cottony substance, are easily carried away by the wind.

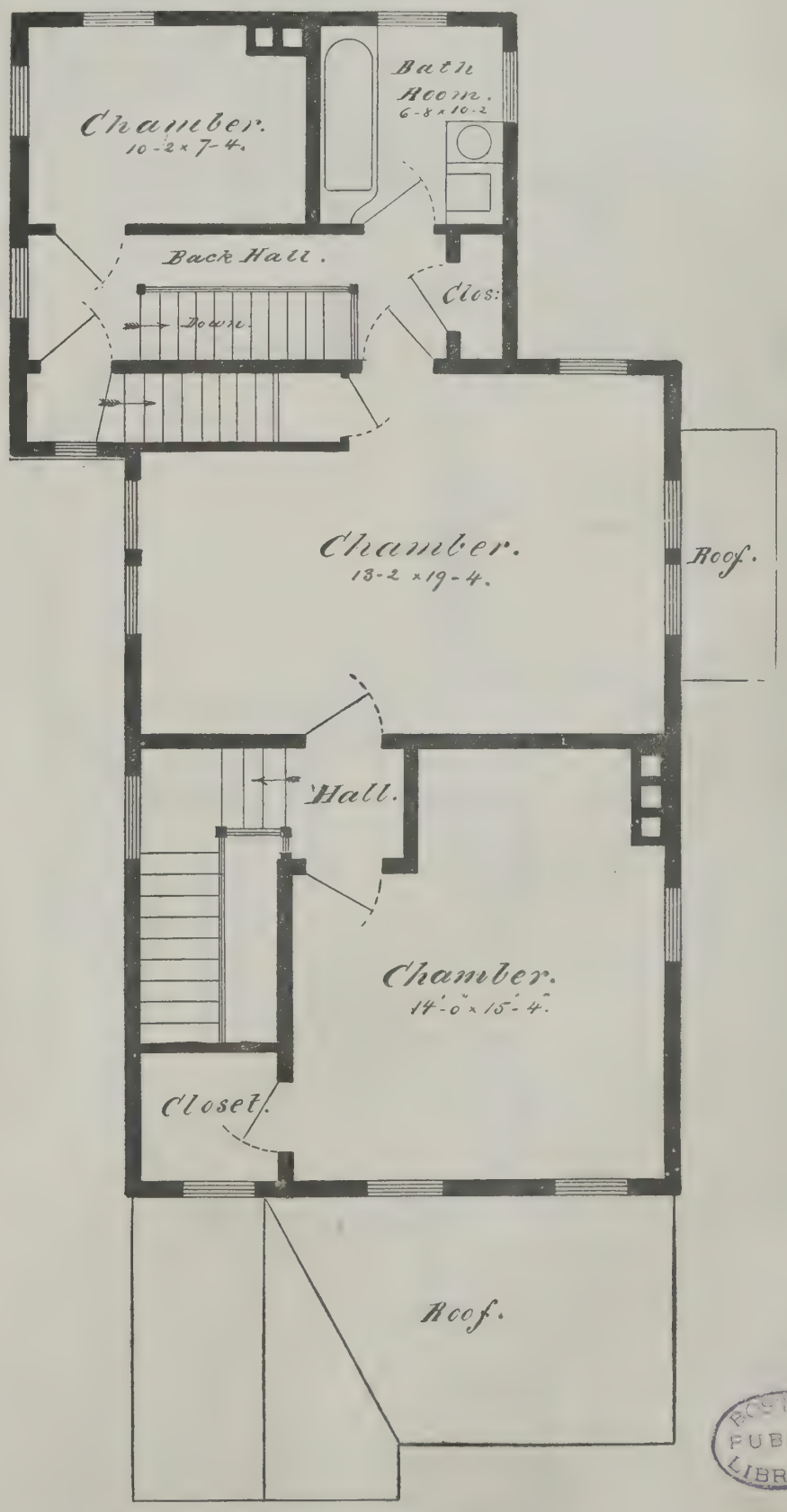
The goat willow (Salix caprea) is another hardy native tree that will grow to a useful size in both marsh and mountain land, and I am astonished that it is not more extensively grown in such places. Although it is generally found inhabiting low-lying, damp ground, yet it is by no means confined to such, and some of the best trees I have ever cut of this species were growing on a mountain slope on loose friable soil resting upon limestone, and at an elevation of about 1,000 feet above sea level. The trees referred to here were growing in the natural forest, and although they were not tall, yet they had fine clean trunks of sufficient size to be cut up into planking and boarding for a variety of purposes. The wood is highly prized by quarriers and contractors, who use it extensively when it can be got for linings to carts, wagons, barrows, etc. Its chief recommendation is that it yields to pressure like a piece of cork, and is not readily injured by the chafing of stones and other hard material. When the trees are young they require a little attention in the way of pruning, but when once they are fully established they are easily kept in proper form by removing rival leaders and cutting back the strong, rambling side branches, in order to direct the energy of the plant as far as possible to the formation of wood in the main stem. The willow tribe is very numerous; many of the trees, besides being highly ornamental and useful, may also be grown profitably. This of itself ought to be a great inducement to owners of marsh ground to extend the culture of the willow in such places, in order to assist in the payment of the rent. The tree is so easily propagated, that the cost of its extension is very trifling. Any handy laborer can prepare and insert the cuttings in nursery lines as a preliminary step to having the plants put out where they are to remain. The cuttings may be made about a foot long, and the buds removed with the finger and thumb, with the exception of three, which should be left at the top to form the head of the plant. The cuttings should then be inserted in a piece of light soil of a sandy texture. The willow is so hardy that it will root in almost any soil, and I have occasionally planted the cuttings with success on damp heather moor ground without any preliminary preparation whatever. But although the willow will grow on wet, marshy ground, yet my experience is that it will always pay to drain such ground, as the trees are much healthier, grow more quickly, and attain a larger size in a given space of time, and consequently give a better return. In some exceptional cases where the soil was liable to be occasionally flooded by water, and where draining could not be properly carried out, I have had the ground thrown up into ridges some five feet or six feet broad, and a row of trees planted along the center of each.—*J. B. Webster, in the Garden.*

Interior Decorations,

a long quarto, containing several colored plates of interiors, "The vestibule, a staircase hall, the drawing room, a morning room, the dining room, the bed chamber," has been issued by Messrs. M. H. Birge & Sons, Buffalo. It is a handsome and artistic production.

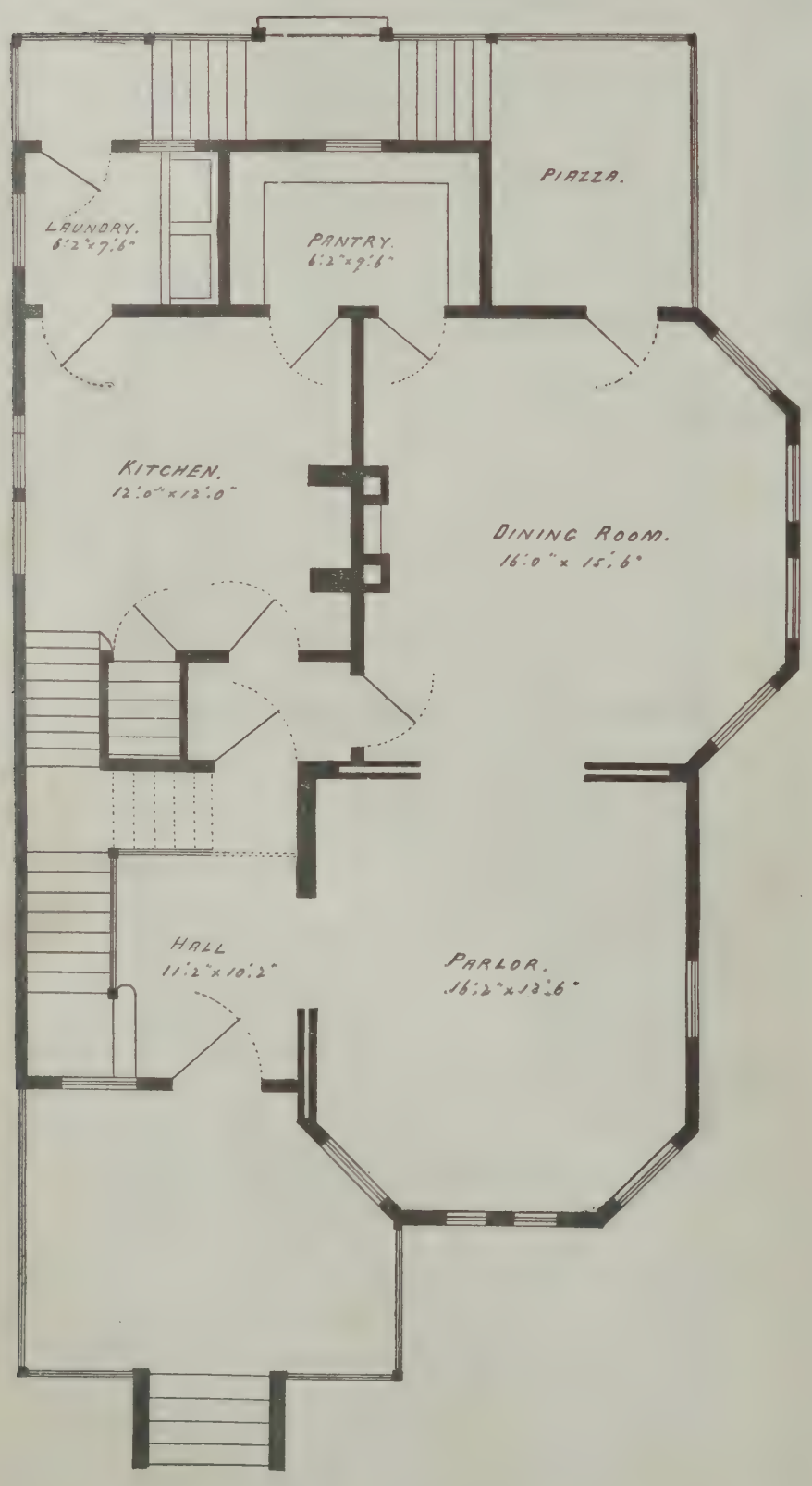


FIRST STORY PLAN.

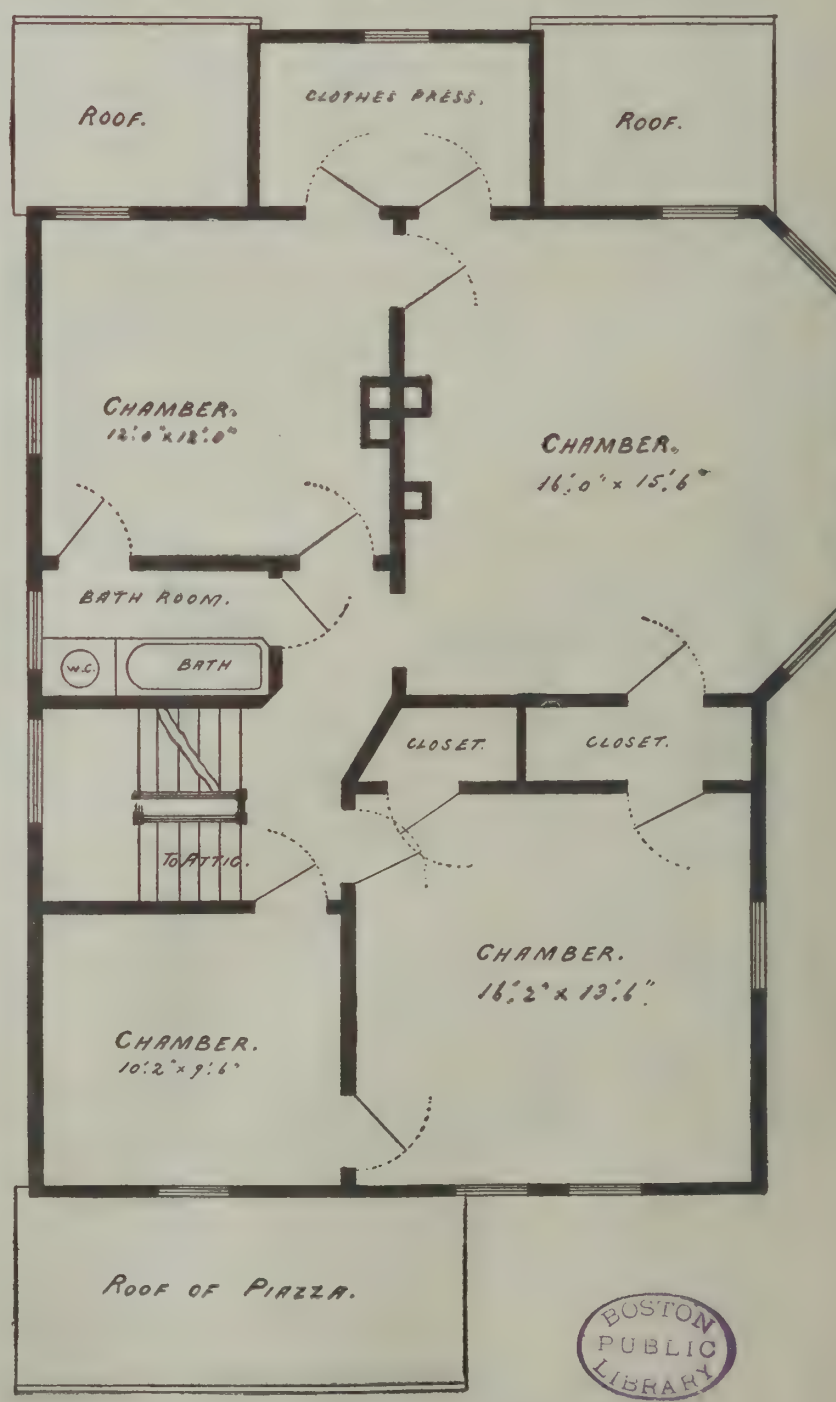


SECOND STORY PLAN.

A DWELLING FOR $2,200.—[For description see page 74.]



FIRST STORY PLAN.



SECOND STORY PLAN.

A HOUSE COSTING $3,200.—[For description see page 73.]

A DWELLING FOR $2,800.

We give herewith an attractive design for a house to cost $2,800, sent to us by Mr. E. L. Messenger, architect, Orange, N. J.

The frame of the house is of spruce or hemlock, the first story covered with clapboards or siding, and the second story and roof of spruce shingles.

The floor plans of first and second stories show the sizes of rooms. In the attic are two more rooms.

The interior is finished in pine and painted. The house can be substantially and neatly built for the sum mentioned.

A HOUSE COSTING $3,200.

Size of Structure.—Front 29' 6". Side 39', not including the piazzas.

For size of rooms see floor plans. Height of cellar 7', first story 9' 6", second story 9'.

Foundation of stone. First and second stories clapboarded, gables shingled, roof slated. Cost, without furnace and mantels, $3,200.

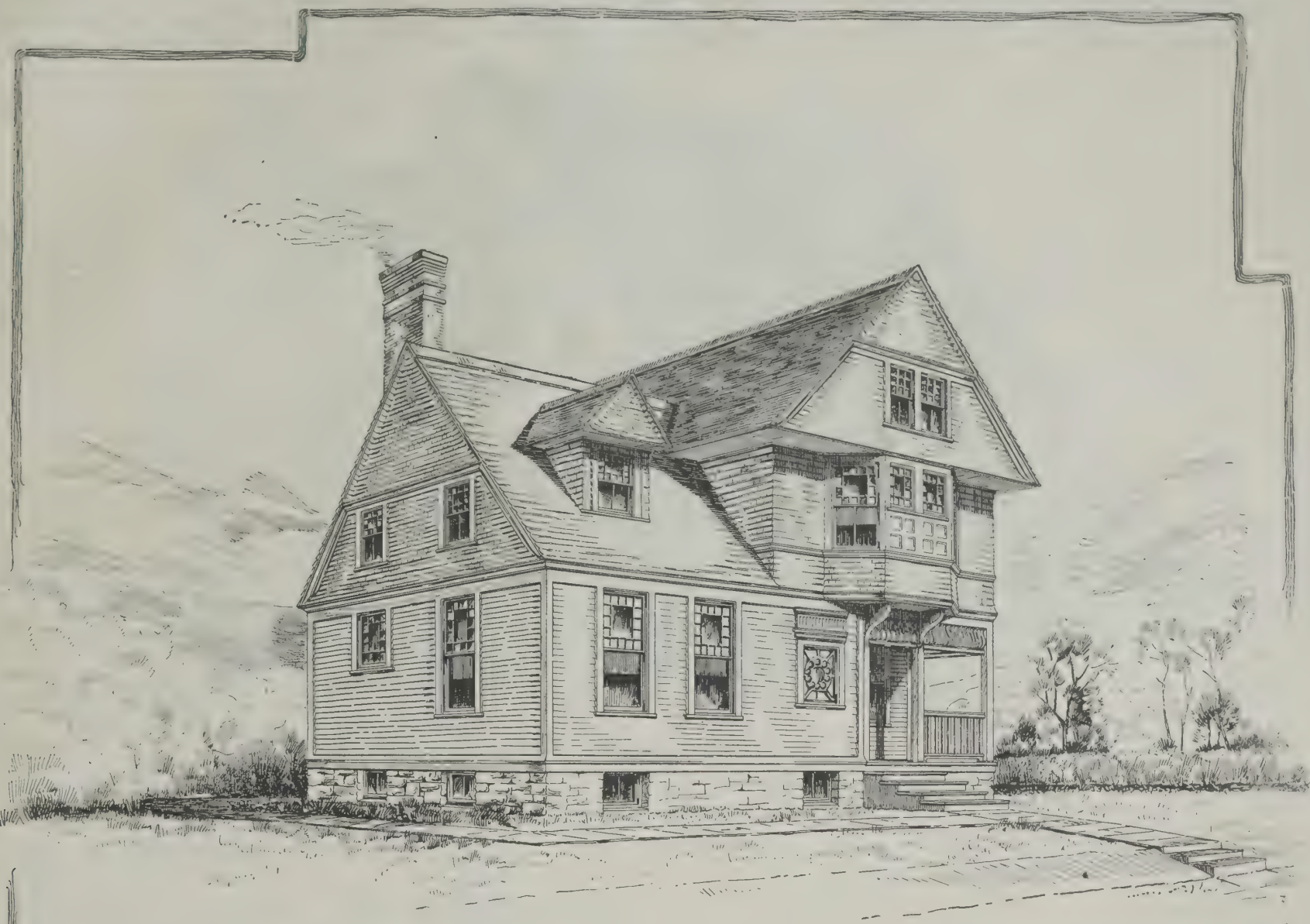
Special features, fireplaces in dining room and chamber over. The attic has two finished rooms. Hall and a large open garret back stairs running from kitchen to platform of main stairs. Cellar under whole house.

A $4,500 HOUSE.

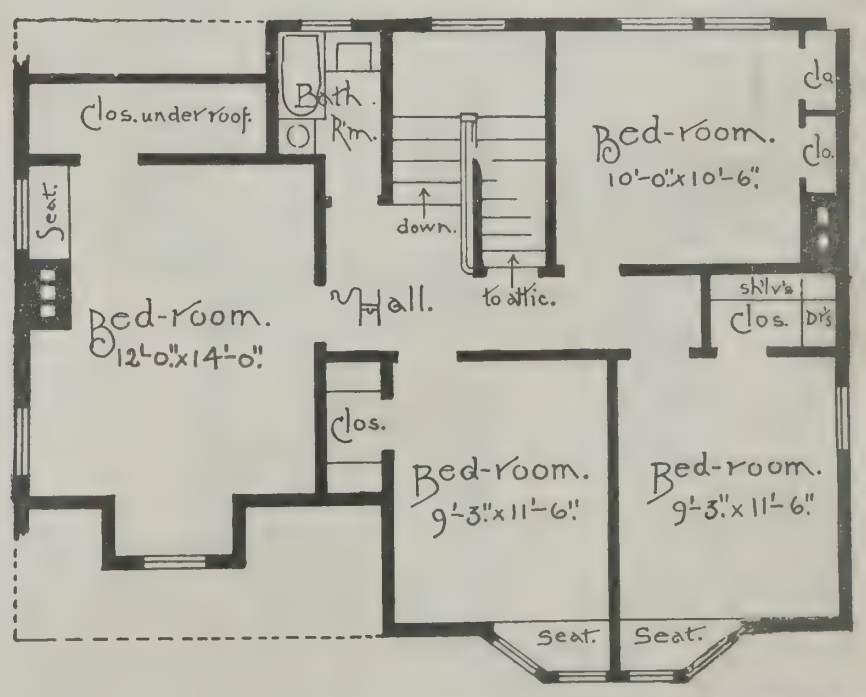
The front measures 31' 4", sides 42', not including piazzas. For size of rooms see floor plans. Height of cellar 7', first story 9' 6", second story 9'.

Foundation stone. First and second stories clapboarded. Gables shingled. Roof, slate. Cost, $4,500, without mantels and heater.

Fireplaces in library and chamber above. The attic has two rooms and hall finished. Large open garret. Cellar under whole house.



First floor plan.



Second floor plan.

A DWELLING FOR $2,800.

After eating, a person weighs more than before.

A DWELLING FOR $4,500.

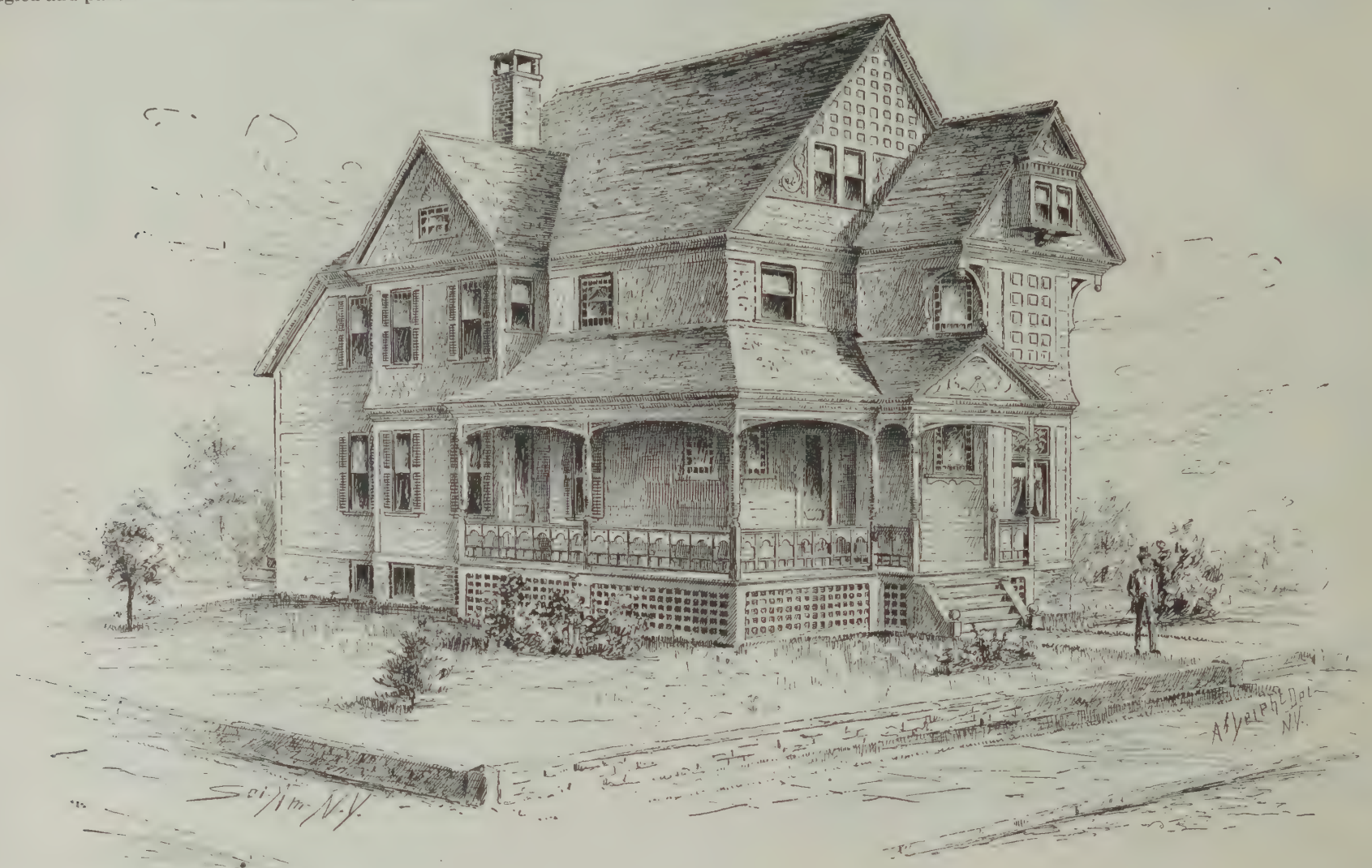
Foundation walls of stone. Underpinning common brick in colored mortar. Cellar under entire house, and seven feet six inches high. First story nine feet high. Second story eight feet six inches high. The exterior frame sheathed, papered, and clapboarded first story. Second story shingled. Roof shingled. Gables shingled and paneled. Prominent features—piazza, bay window, gable oriel window, and ornamental gables. Interior has eight finished rooms besides pantry, lavatory, bathroom, and closets. The hall and staircase are pleasing and attractive features. By reference to the floor plans it will be seen that all of the rooms are convenient and pleasantly located. The dining room and kitchen to have hard wood floors. The house to be finished in whitewood, natural finish, throughout. The parlor, nursery, and the two chambers above are to have open fireplaces. The exterior to be painted three coats. Roof two coats of creosote stain, etc. Estimated cost, $4,500. Architect, W. H. Harvey, Worcester, Mass.

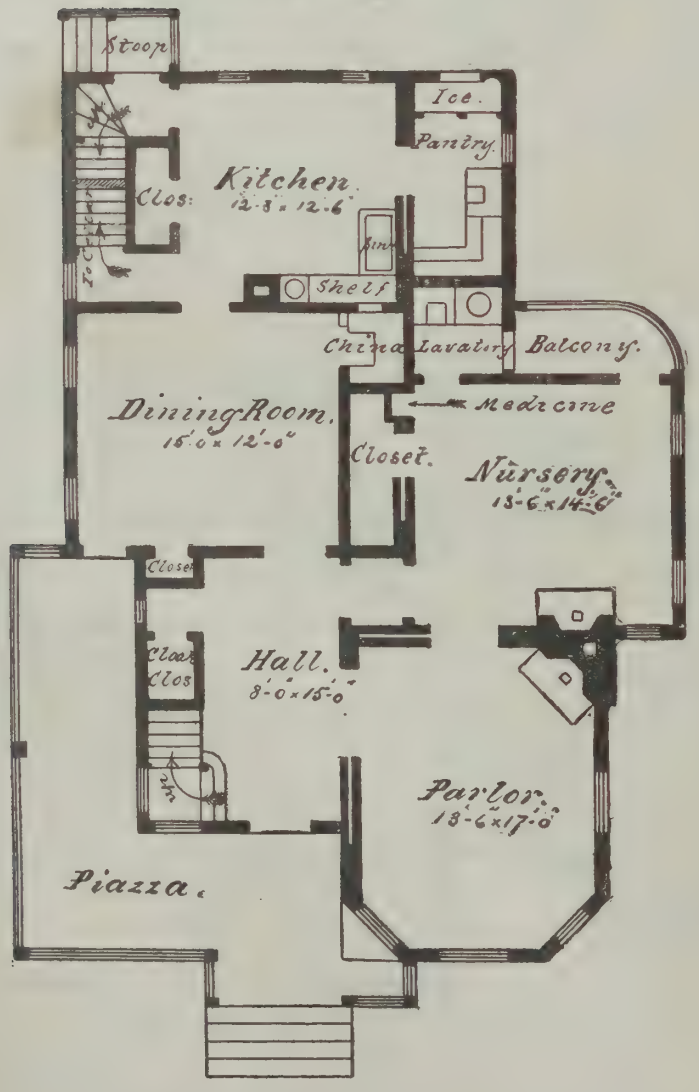
A DWELLING FOR $2,200.

The front 20′, side 42′, not including the piazzas. For size of rooms see floor plans. Height of cellar, 7′. First story 9′, second story 8′ 6″.

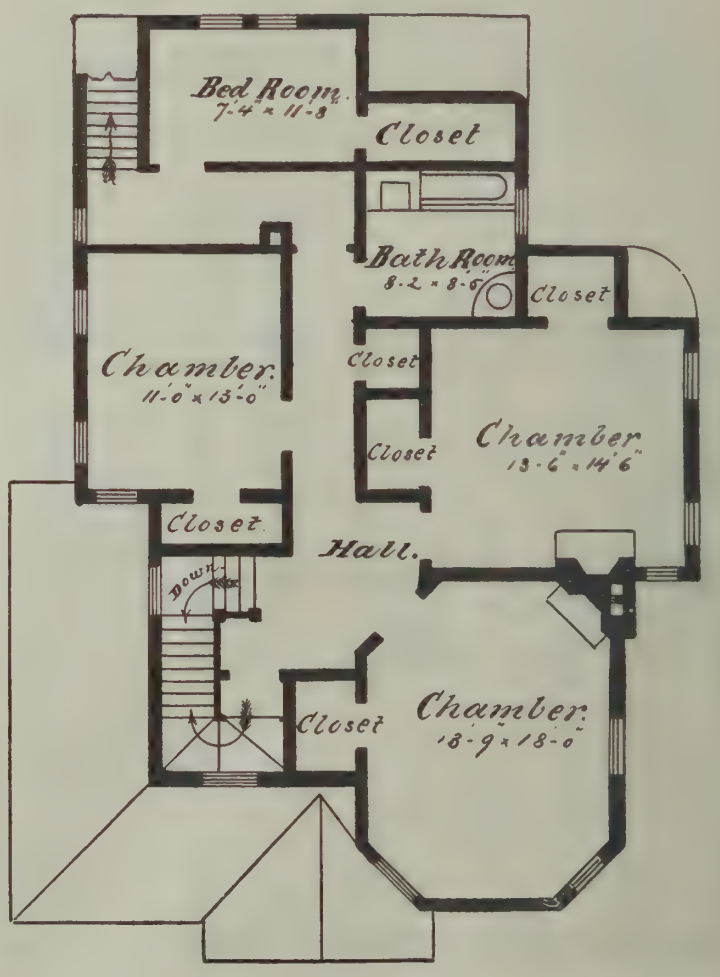
Foundation, brick. First and second stories clapboarded, gables shingled, roof of slate. Cost $2,200, without mantels and furnace.

An open fireplace in parlor and also in dining room. The attic is floored and has a large open garret. Cellar under whole house.





First Floor.



Second Floor.

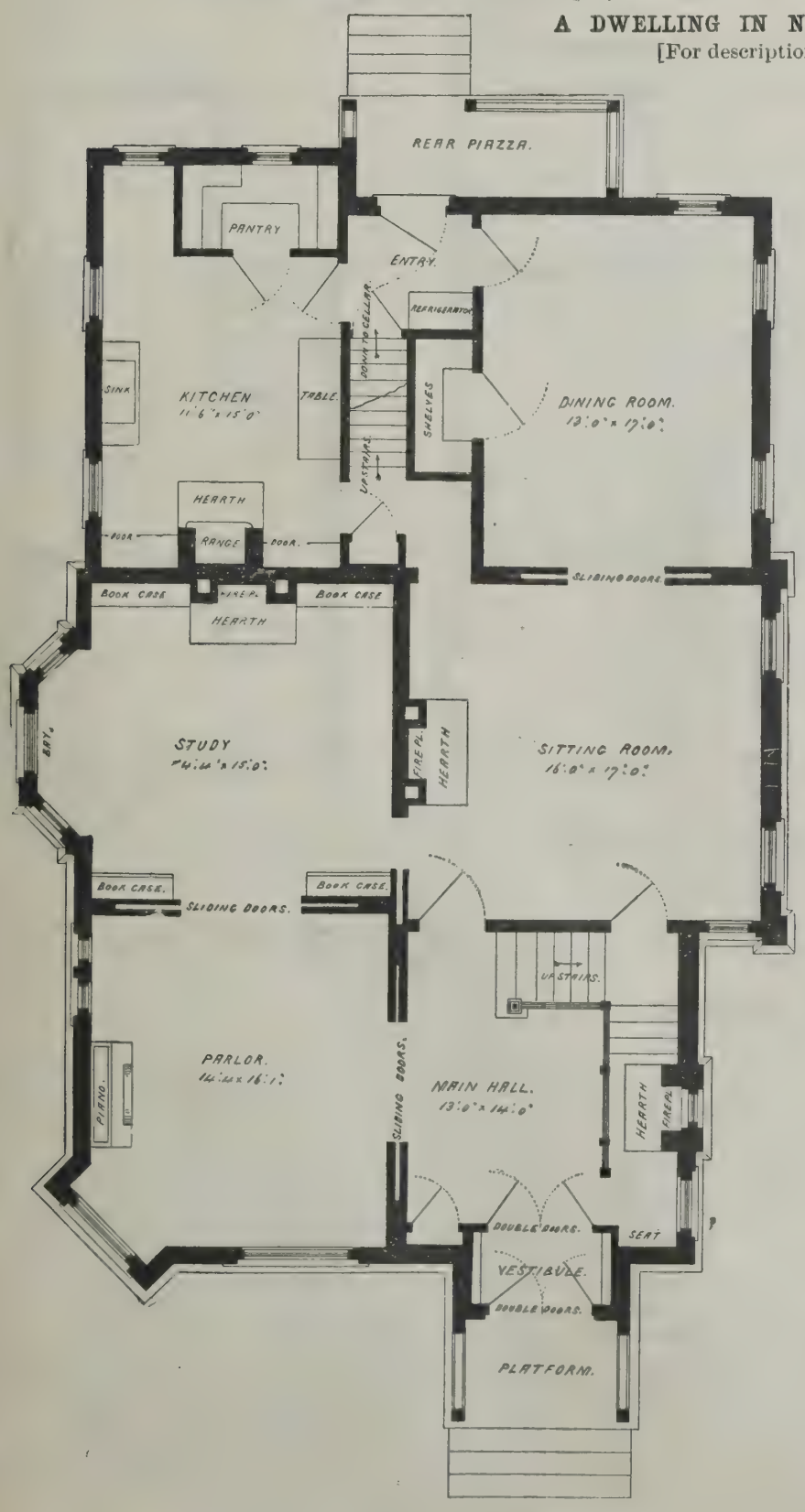
A DWELLING FOR $4,500.

Rats and Matches.

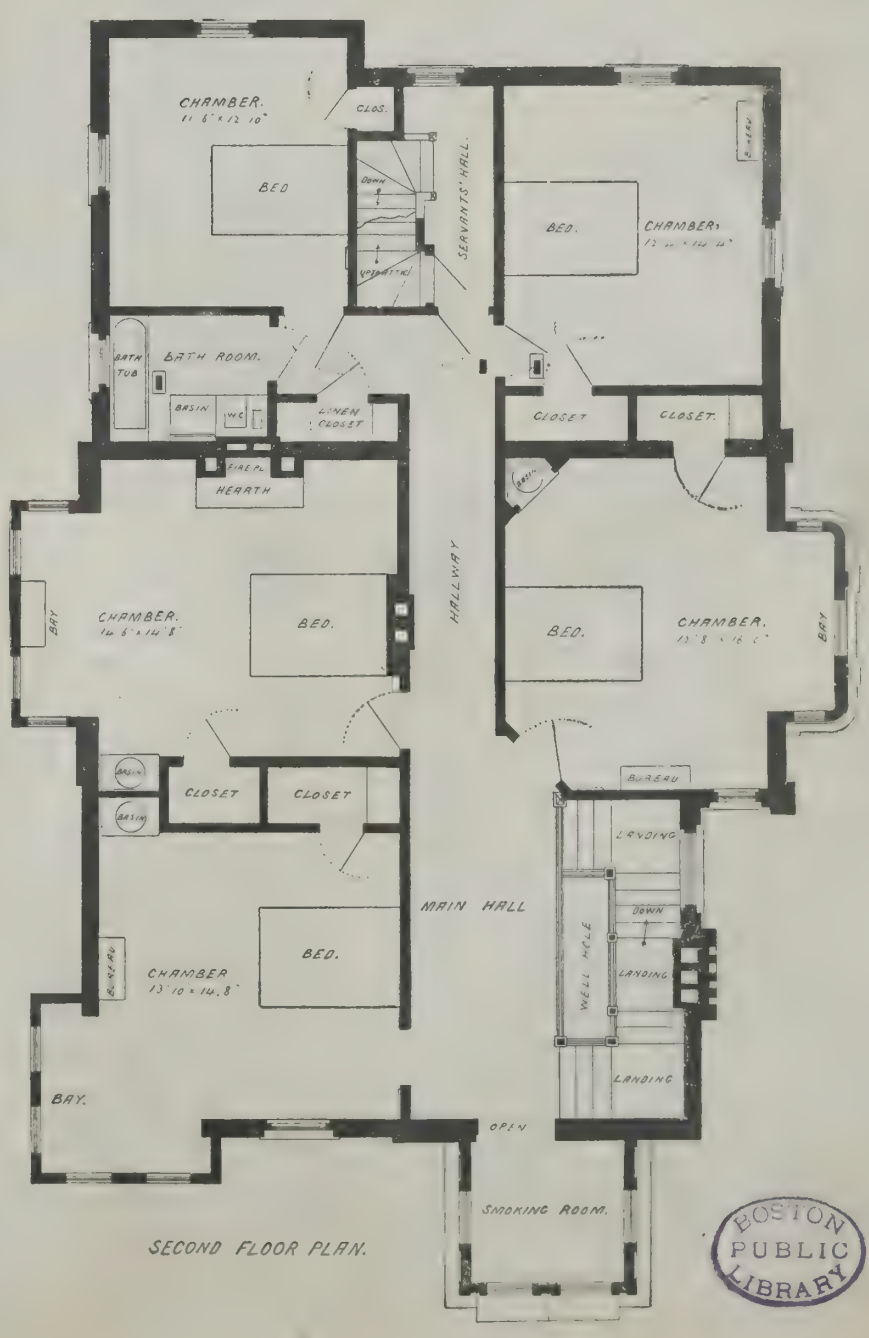
Fire Marshal Whitcomb, of Boston, has been recently experimenting with rats and matches, shut up together in a cage, in order to ascertain whether they were likely to cause fires or not. In the absence of other known cause frequent fires have been ascribed to their agency, while at the same time many underwriters affected to scoff at the idea. The question may, however, now be considered as settled. The very first night that Marshal Whitcomb's rats were left alone with the matches four fires were caused, and not a day passed while the experiment was being tried that fires were not set in this way. The rats were well fed, but they seemed to find something in the phosphorus that they liked. It was noticed that only the phosphorus ends were gnawed.—*Fire and Water.*

A DWELLING IN NEW HAVEN, CONN.

[For description see page 76.]



FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

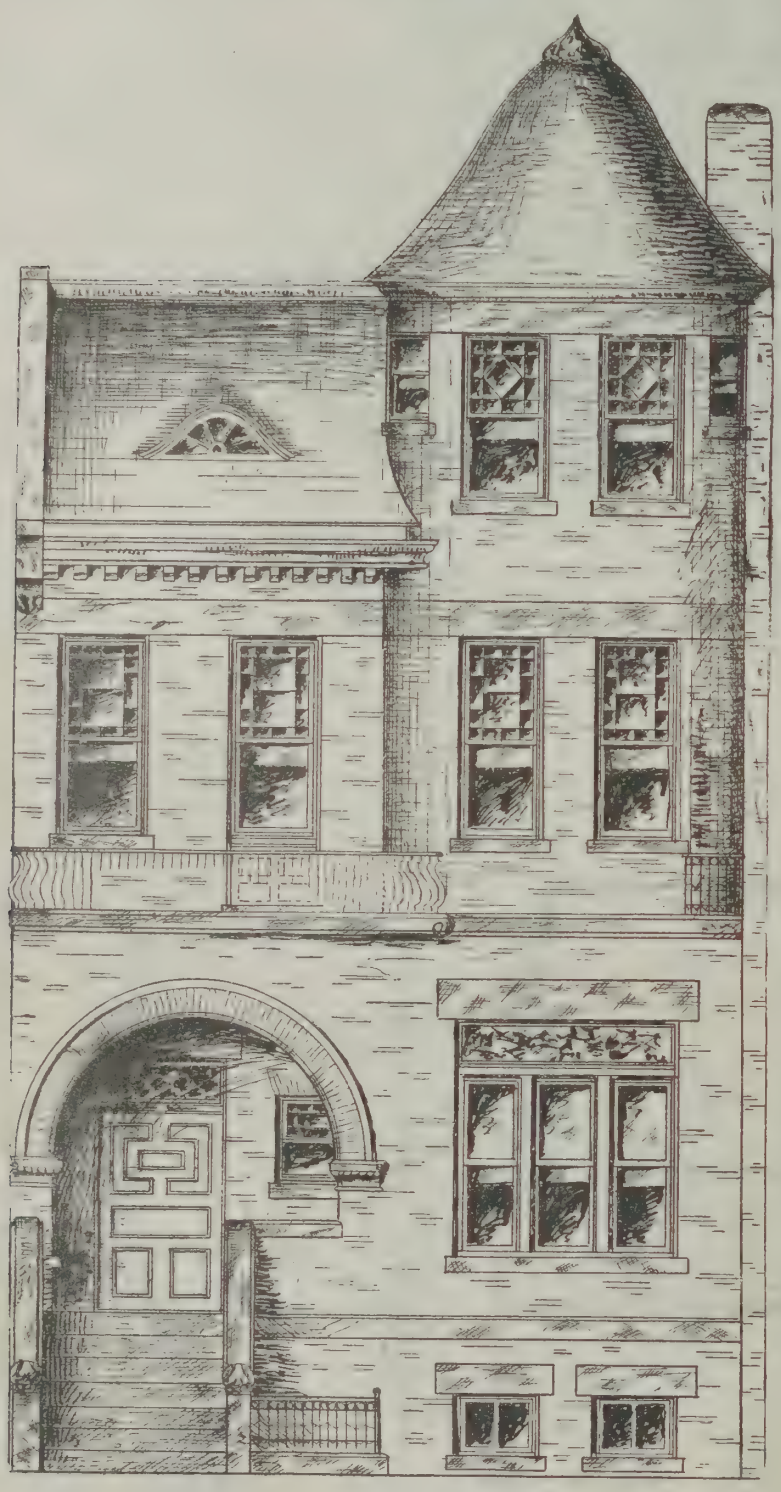
A CITY HOUSE OF MODERATE COST.

By W. L. Clarke, architect. Alexandria, Va. Front to be of No. 1 dark red pressed brick, laid in red mortar. All sills, lintels, chimney caps, belt courses, front steps, steps to basement, and copings to be of brownstone.

The first floor consists of parlor with square bay, separated by a screen of Moorish fretwork. Library, with screen of fretwork and stained glass windows. Staircase separated from library, also by screen. Dining room with dresser, dumb waiter and stairs leading to kitchen in basement.

Second floor, bed room over parlor, with circular bay, separated by plain plaster arch. The position of door leading to balcony over vestibule has been, as you will notice, changed. Bed room and bath room over library and bed room over dining room, and two bed rooms on third floor.

Roof to be finished with red tile and copper. Wood work of first floor (with exception of dining room) and hall, front bed rooms of second and third floor to be of cherry finish, the balance of pine, hard oiled. The upper sash of all front windows and transoms to be of stained glass. Vestibule floor to be of tile, laid in cement. The estimated cost complete is $6,500.



DESIGN FOR BRICK FRONT
W. LEON CLARK - Arch't. — Alexandria, Va.

W. L. Clarke, Archt.
Alexandria
Va.

A DWELLING IN NEW HAVEN, CONN.

On page 75 we give a sketch of a residence for Prof. R. H. Chittenden, of Yale Scientific School, which is located on the corner of Temple and Trumbull Streets in New Haven. This house was finished last year, at a cost of $10,000 to $11,000, from designs made by C. H. Stilson, architect. The feature of the plan is a large square entrance hall, with finish, fireplace, mantel, and stairway of antique oak. Tesselated "quartered" oak floors. Hard wood casings, doors, and mantels, and library and other finish throughout the first floor. The entrance hall, vestibule, and stairway have the windows of artistic stained glass and plate glass work, and the main part of the house has the

Wood, Plaster, and Concrete.

The respective merits of these materials in the construction of buildings have recently been reviewed in their relation to the acoustics of theaters, and the general gist of opinion is that concrete has proved a success. It is obviously difficult to compare two materials like wood and concrete, so different in their physical properties. But for the inflammable nature of wood, it must be admitted to be the most desirable acoustically for the lining of rooms and halls adapted for music. The Italian congress of architects, in 1880, laid down certain rules respecting the form and materials desirable for halls of music and theaters, one of which was that wood was the proper material to augment the energy of sound, and giving preference to fir; they also recommended that the room should be lined with wood, isolated as much as possible from the fabric of the building; that the soffit of the theater (ceiling) and the fronts of the boxes should have their surfaces composed of thin planks fitted together like boxes, and the columns should be of wood, also hollow.

These recommendations, obviously intended to promote resonance, are opposed to all our ideas of incombustibility, and, in fact, would promote the spread of flames. No better prescription for an inflammable interior could be given than that the hall should be lined with wood isolated, and that the boxes should be separate boxes of wood.

Her Majesty's Opera House, destroyed by fire in 1867, was entirely of wood lining, forming resonant surfaces, fixed to the walls at as few points as possible, so as to yield to the vibrating mass of air, and this construction has more or less prevailed.

From acoustic considerations, then, wood is preferable to all other materials as a wall lining, but its inflammable nature renders it undesirable in the construction of the auditorium of a theater. For the re-enforcement of sound it stands foremost; in other respects its presence adds materially to the risks of fire. The employment of plaster or cement is undoubtedly inferior as an acoustic surface; it has none of the vibrating properties of wood: the sound waves recoil and produce confused sounds.

On the other hand, it has a protective value which renders it desirable for ceilings, the covering of column and gallery fronts, and the patent plasters which are employed are easily and cheaply applied.

Of late years the introduction of box divisions of concrete slabs, as employed by Mr. Tavenor Perry at the Alhambra, and a system of partition construction of angle iron and wire netting plastered, have superseded wood. These materials are less resonant and vibrating, but when they are employed in halls and theaters of moderate dimensions, no acoustic objections have been discovered. Concrete is a material, above all others, that must take the place of wood in large halls and auditoriums; slabs of concrete can be made of sufficient resonance to aid the sound instead of absorbing or reflecting the waves, and a thin shell of it or of fireproof plaster is the best kind of ceiling.

Mr. William White, F.S.A., referred, the other day at the Institute, to the acoustic value of fibrous plaster and concrete. Where the stage was made of concrete, it gave back a sharper sound than boarding—an experience that was borne out by Mr. Robert Walker, who had used concrete in the Kensington town hall, and instanced the use of it at Terry's theater.

Similar evidence of the value of plaster has been given by Mr. Ralph Nevill, who states that plaster gives the "clearest and most rapid resonance." Taking, then, the relative advantages of each material for interior linings of such buildings as we have considered, concrete has merits which cannot be disputed. There is a quick resonance, less full and sonorous than wood, but still sufficient to aid the voice when the conformation of the hall or auditorium is favorable, while it is indestructible by fire if properly made.

For flooring purposes the adoption of a fire proof floor of concrete or of flat brick like that of Homan & Rodgers does not necessarily imply the desirability of a hard surface; wooden floor boarding can be used. One merit of wood we have omitted—namely, its warmth and comfortable appearance—a quality which we estimate at its true value in a domestic apartment, but not in a public hall. Wooden linings and wainscoted walls will always be esteemed by the architect.

The claims of its rivals—plaster and concrete—become strong only when we have to consider other qualities, such as cleanliness, durability, and fire resistance. Interior surfaces should be adapted to the purpose of the building, and if this test is invariably applied, fewer mistakes are likely to be made. We do not mean to say that concrete has any strong artistic claim in its favor—there is room for adapting it for internal surfaces and partitions; but as it can be built up *in situ* or used in slabs, it admits of architectural treatment in a manner that gives it some preference over stone or even wood.

The three materials we have named will continue to enlist the sympathies of architects; it is for them to consider the merits of each for its particular purpose, and to decide which is most capable of fulfilling the object the best.—*Building News.*

A COUNTRY HOUSE IN CONNECTICUT.

We give from *Building* a sketch of a country residence designed for an elevation. Architects, Rossiter & Wright, New York. The house presents a substantial appearance, and the design is in many respects desirable.

A COUNTRY HOUSE IN CONNECTICUT.

BULBOUS PLANTS FOR APARTMENTS.

Whoever occupies himself with plants likes to see them grow and prosper before his eyes. Yet every one knows that it is often difficult to cultivate flowers in our dwellings, close to us, and usually it is necessary to limit one's ambition to seeing them preserved in the room and to prolonging their existence in the surroundings in which one is placed. The reason is that the majority of the elements necessary for their development are totally wanting, and that other agents, on the contrary, act upon them unfavorably. What they especially need is light, and what injures them most is the dryness of the air and the action of the dust.

There are, however, certain plants that will grow and thrive in rooms, and these have the inappreciable advantage of allowing us to witness their development; and they afford us the pleasure of following step by step the progress that is made each day.

It may be of interest to know to what cause this peculiar manner of behaving is due. The ordinary plants that we have in our rooms do not find in their surroundings the elements necessary for the formation of the materials that must make provision for their increase. Their roots and leaves do not thrive well, and the plant is soon reduced to living upon its own substance. We here have a phenomenon of autophagy, which is shown first by the yellowing and then by the withering of the basal leaves, that is to say, those that are the oldest.

Mr. Deherain has shown that most plants, at the time of the maturing of their seeds, utilize the useful

Fig. 3.—HYACINTHS IN PORCELAIN BASKET.

principles stored up in their organs by a phenomenon of migration. He has shown that in wheat, for example, the leaves gradually become exhausted of the useful elements that they contain in order to concur in the formation of the seed. What occurs in the plant that has reached a normal state at the end of its development operates in every vegetable which, placed in unfavorable surroundings, can no longer manufacture in sufficient quantity the materials necessary for its increase. It therefore draws upon the provision made by the old leaves, which soon become yellow and drop off. But such provision is not sufficient to permit the plant to grow indefinitely, and the latter is soon exhausted and dies.

Bulbous plants have the advantage over all others of containing a supply of food in the bulb that permits them to provide for the development of leaves. This is not a simple hypothesis; experiment on the one hand and direct observation on the other decide in favor of this view. In fact, if we preserve the bulbs that have been cultivated in a room, and plant them in a garden the next year, it will be found, not without surprise perhaps, that they will produce scarcely any leaves, and that, at all events, no flowers will be obtained. The reason of this is that the plant, at the time it was cultivated in a room, became exhausted of all the useful elements contained in its bulb, and that the leaves and roots have not been able to form a new supply of food again.

Whatever be the cause that allows bulbous plants to develop easily in our dwellings, it is interesting to know the fact that they do, for these plants are admirably adapted to the ornamenting of apartments. The number of these flowers of so simple culture is quite large. Yet all do not succeed with the same ease. For certain of them, it suffices to put the bulb in contact with water to see it soon produce roots that will rapidly elongate and live in the liquid element. For this sort of culture, special vases have been devised that are provided at the top with a wide mouth in which the bulb may be placed (Fig. 1).

Of all bulbous plants, the hyacinth—that charming plant with racemes of bells of all shades, so elegant and with so penetrating a perfume—is the one best adapted to this sort of culture. The production of its bulb in Holland, where it is specially cultivated, has given rise to a very large business. All varieties of it, however, are not equally adapted to culture in vases. Those with simple flowers and strong roots give the best results. The varieties with double flowers have the disadvantage that they often expand imperfectly.

Now is the time of the year when the culture succeeds best. It is well to select large and healthy bulbs, and to so place them in the vase previously filled with water that the latter shall touch their lower part. These vases may, for a time, be placed in a closet. It is important that the place in which they are put shall be only middlingly warm, for too great a heat would make the leaves develop before the roots, and the flowers would be stunted. As soon as the roots are numer-

Fig. 1.—HYACINTHS IN VASES.

Fig. 2.—POTTED CROCUSES.

ous and the leaves begin to appear, the moment has arrived for placing the plants in the light. On a table near a window is the place best suited to them, although they are capable of growing far away from the direct light. In most cases, it is well to support the racemes of flowers with a prop in order to prevent them from lopping over.

This prop should be a slender stick, which, sharp at one end, may be stuck into the bulb and be tied to the raceme, the number of flowers in which often renders it so heavy that it cannot preserve its rigidity. Then we shall soon see the flowers opening one by one, and the elegant raceme of bells will send its penetrating perfume throughout the entire room, and we shall enjoy them for a long time.

Sometimes, by way of amusement, the hyacinth is made to flower abnormally. Two bulbs are placed in a glass vase having a large aperture at each extremity. One of the bulbs is placed in the bottom, upside down, the vase is filled with earth, and the second bulb is placed in the top, right side up. This vase is set upon another one filled with water. In a short time the two bulbs will develop, one growing normally, and the other throwing its leaves and flowers down into the vase filled with water (Fig. 1).

The culture of bulbous plants in apartments allows of very varied combinations. Very good success is obtained by planting the bulbs in earth simply. For some years past, quite an extensive series of models of earthen vases, especially adapted for this culture, have been sold in Parisian stores. One of those best adapted to the happiest combinations is shown in Fig. 2. It consists of a spherical earthen vessel containing numerous apertures in its sides. In front of each of these holes is placed a flowering bulb, and the vessel is then filled with earth, or with chopped-up moss rammed down so that the bulbs may be regularly supported. The operation is finished by planting in the upper part of the vase several bulbs that will furnish an abundant growth of leaves and flowers.

In parlor cultures, these earthen vessels are advantageously replaced by Chinese or Japanese faiences, or by vessels of colored porcelain (Fig. 3). In this combination, chopped moss should always be used instead of earth, which would soil the vessel and might even injure it. In this way, we may obtain the most charming effects, and, at slight expense, provide for a continuous succession of flowers during the long winter months, and precisely at the moment in which, deprived of the sight of all vegetation, we best appreciate the pleasure of having a few beautiful fresh flowers about us.

Hyacinths, however, are not the only bulbous plants that can be cultivated in apartments. They are the ones that succeed best in vases, but narcissuses, jonquils, and amaryllises may be cultivated in the same way. All bulbous plants flower well in chopped moss, and the crocus and tulip, likewise, can therefore be employed for this purpose. On combining these different plants, we may obtain excellent effects and a continuous succession of flowers for the entire extent of the inclement season.—*La Nature.*

DRAWINGS FROM THE ARCHITECTURAL LEAGUE.

We give a page of drawings representing some of the exhibits of the late display of the Architectural League of New York.

The row of New York houses gives an idea of the growing tendency to return to the old colonial style of dwellings.

The Spanish grille is from a famous Spanish house, called the House of Pilate, in Seville. The house was designed in the style of the Alhambra, and the feature of it is the large patio off which the rooms are arranged. The floors and walls are tiled in the curious Moorish tiles, and the hall is completely tiled, walls, sides of stairs, etc., making a peculiarly rich effect. The grille is taken from a window looking out into the superb garden, and facing groves of palm, orange, and lemon trees. This is reproduced from a sketch by Charles A. Rich, architect, of New York City.

A SPANISH GRILLE.

French Farm House.—Taken from an old place midway between Dieppe and Paris, and shows the beautiful arrangement of interior courtyard. The window spaces are few, it will be noticed, on the court, but abundant on the outer side. There are many examples of this planning in France, another noted one being the Chateau d'Anjou, at Dieppe, built in flint stones laid like mosaic. They are both examples showing the beauty of simplicity of design. This, also, was sketched by Charles A. Rich.

A FRENCH FARM HOUSE.

Color in Greek Temples.

The discovery of Greek temples colored on the exterior is doubtless a very remarkable fact in archæology, for if any monuments seemed to reject the application of colors to their external decoration, it was assuredly those of the Greeks. At this day it is impossible not to admit that it was among these people that the alliance of colors with architecture was made, not in the declining epoch, but at a period when monuments were erected in the best style; in fact, the ruins of colored temples discovered by the excavations made in Greece, Italy, and Sicily, in places where many Greek colonies prospered, have this characteristic in a remarkable degree. If we seek the cause which determined the Greek architect to seize upon one of the most powerful means that the painter has of addressing the eye, we shall find it especially, I think, in a taste for colors rather than in the intention of rendering the various parts of an edifice more distinct from each other, and of substituting painted ornaments; indeed, the communication of the Greeks with the Egyptians may have induced them to imitate the latter in this application of colors to ornaments. In the colored drawings of Greek monuments which I have been able to procure, I have remarked not only the number of colors employed in these monuments—white, black, red, yellow, green, and blue—but also the use which has been made of them under the relation of variety and purity of tint, of distinct view of the parts, and of the harmony of the whole. For instance, the principal lines, as the fillets of the architrave and of the cornice, are red; the mutules blue and their guttæ white; the triglyphs blue, the channels black, and their guttæ white; and the more extended parts of the frieze and the cornice, as well as the architrave, are of light yellow. We see that red, a brilliant color, indicated the greater part of principal lines; that blue, associated with black, in the triglyphs and their channels, formed an harmonious and distinct union of the neighboring parts; also that the dominant color, light yellow, produced a much better effect than it would if the most intense or the most somber colors had predominated.—*E. Chevreul.*

Fever from Sewer Gas.

An epidemic of typhoid fever has been prevailing at the Michigan State prison at Jackson. A committee from the State board of health was invited to make an investigation of the causes of the epidemic. The water supply and milk supply were first ruled out as possible vehicles by negative evidence. It was then thought that the defective condition of the sewers, combined with the insufficient suppy of fresh air, was the most probable cause of the epidemic. The cases nearly all were from a distinct portion of the prison, and investigation proved that the soil pipe running from the hospital and the house drain into which it entered were defective. Professor Vaughan took to his laboratory a sample of the air from within the soil pipe, and has found within it the specific germ of typhoid fever. This fact explains the epidemic. The first case may have been introduced into the prison in a new prisoner, but once the germs of the disease were introduced into the soil pipe with the undisinfected fecal discharges of the patient, the infected soil pipe and sewer spread it freely throughout the prison. The committee from the State board of health recommended that before there is any digging into the sewers or drains, there should be thorough disinfection by pouring into the drainage system half a barrel of solution of bichloride of mercury, one part of chloride to four hundred of water; that, after such disinfection, the soil pipe leading from the hospital be taken up and reconstructed under the direction of a competent sanitary engineer.—*Sanitary News.*

A ROW OF NEW HOUSES, NEW YORK—J. H. DUNCAN, ARCHITECT.

New Use for Dynamite.

According to the *Revue du Genie Militaire*, Capt. Bonnaford, in the new fortified enceinte now constructing at Lyons, is having recourse to dynamite for instantaneously drying up infiltrations of water in the earth in which it is desired to establish foundations. A hole ten or twelve feet deep and one and a half inches in diameter is first made in the inundated earth, and a string of dynamite cartridges is afterward let down into it and exploded. The water is at once forced back far from the sides of the ten foot excavation made by the dynamite, and does not begin to leak in again until at least half an hour has elapsed. This gives the workmen plenty of time to clean out the cavity and pour in a quick-setting cement. When water reappears it can no longer injure the foundation. In this way, it has been found possible, in a day of ten hours, to form 68 feet of foundation, through cemented wells about six and a half feet in depth, spaced nineteen feet from center to center.

Wall Plates.

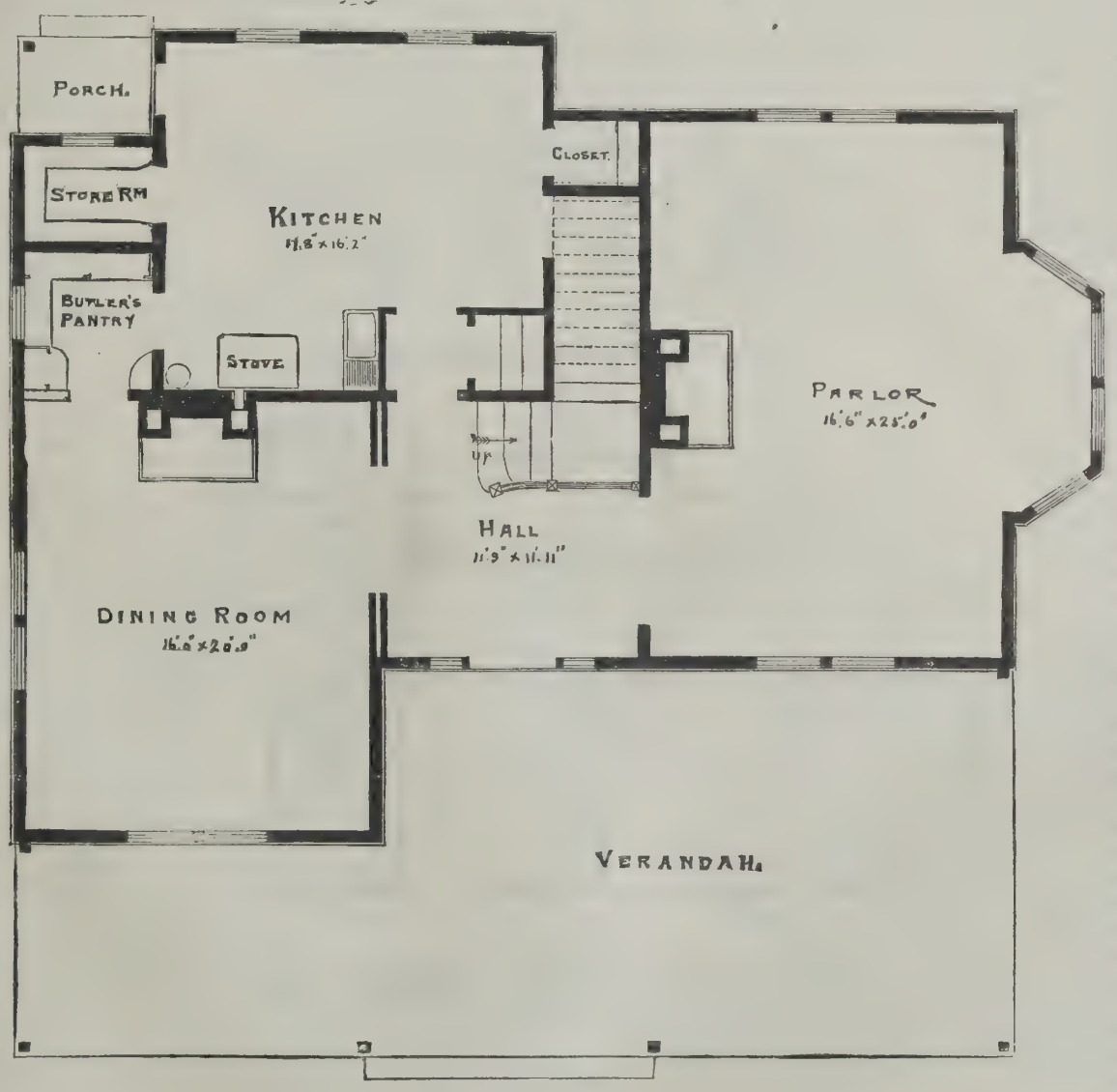
Care should be taken that the surfaces of contact of the wall and the beam are of sufficient area to be unyielding. Usually the wall composed of brick or stone is so firm that there need be no apprehension of its failure, and yet it is well to know that it is safe. It should, therefore, be carefully considered, to see that the given surface is sufficiently large for the given material to carry safely the weight proposed to be distributed over it. In calculations for heavy roof trusses this precaution is particularly necessary. The upper surface of the joint or under side of the beam requires special attention This is usually of timber, and parallel with the fibers of the material. The pressure upon the surface tends to compress these fibers more compactly together, by closing the cells or pores which occur between the fibers. When pressed in this way timber is much more easily crushed, as may readily be supposed, than when the pressure is applied at the ends of the fibers in a line parallel with their direction. The resistance to side pressure approaches the resistance to end pressure in proportion to the hardness of the material. By experiments made by the author some years since to test the resistance, it appears that the hardest woods, such as lignumvitæ and live oak, will resist 1½ times the pressure endwise that they will sidewise; ash, 1¾ times; St. Domingo, twice; bay-wood, mahogany, oak, maple, and hickory, about 3 times; locust, black walnut, cherry, and white oak, about 3½ times; Georgia pine, Ohio pine, and whitewood, about 4 times; chestnut, 5 times; spruce and white pine, 8 times; and hemlock, 9 times. Their resistance to side pressure is in proportion to the solidity of the material, or inversely in proportion to the size of the pores of the wood.—*R. G. Hatfield.*

IF any of our readers have made an invention for which they have thoughts of taking a patent, they are invited to communicate with Messrs. Munn & Co., the publishers of this paper, who for a period of forty-three years have conducted a most successful bureau in this line. A pamphlet of instructions will be sent free, containing full directions how to obtain a patent, costs, etc. In very many cases, owing to their long experience, they can tell at once whether a patent probably can be obtained; and advice of this kind they are always happy to furnish free of charge. Address Munn & Co., SCIENTIFIC AMERICAN office, New York.

A SEASIDE RESIDENCE.

This house was erected some short time since at Long Branch, N. J., from the designs of Architect W. H. Beers, of New York City. The plans were drawn up with the view of providing commodious rooms to suit the special requirements of the owner. The elevation of the dwelling possesses several novel features, and has a picturesque appearance well according with its location.

The foundations, walls, and chimneys of the building



FIRST FLOOR.

A SEASIDE RESIDENCE.

are carried up in hard brick, set in lime and cement mortar. The frame of the building is well put together, being braced at angles with posts mortised into sills, girts well framed into posts, and beams notched on to sills and girts. The sills and posts are 4″×8″, girts and plates 4″×6″, braces 4″×4″, and floor beams 2″×9″ on 16″ centers. The roof is constructed of rafters 2″×7″ (20″ centers), collars 2″×7″, hip and valley rafters 3″×7″, and ridges 2″×9″. In the piazza the sills are 4″×6″, plates 3″×4″, floor joists 3″×6″, rafters 3″×6″, purlins 3″×4″, and the posts 6″ square. The floors are bridged in two tiers, and the headers and trimmings are 4″×9″.

On the exterior of the building the whole frame is covered with square-edged hemlock sheathing laid with close joints, and upon this is placed resin-sized sheathing paper, covered with 16″ sawed pine octagonal shingles, laid some 5½″ to the weather. The roof is shingled and finished with cresting made out of 4½″ stuff, as shown on the drawings. For the hips, valleys, gutters, dormers, etc., the best I. C. charcoal tin is employed, painted three coats. Four inch leaders are provided, with the necessary curves, bends, etc., to conduct the water away.

In the interior the floors are of white pine, tongued and grooved, with 9″ moulded base around. The front entrance door is 1½″ thick, glazed in ornamental panels formed out of sash bars. All other room doors are 1½″ four panel flush moulded, and those of cupboards 1¼″. Mortise locks are provided to all outside room doors, and rim locks to closets.

All walls, partitions, and ceilings are lathed and plastered in two coat work. The first and second stories of the house are painted with three coats, and finished in two tints. The newels, balusters, and rails of main staircase in two coats of hard oil finish. On the outside the work is painted in three coats in well selected

tints. The cost of the house was four thousand five hundred dollars.

ECONOMICAL HOMES.

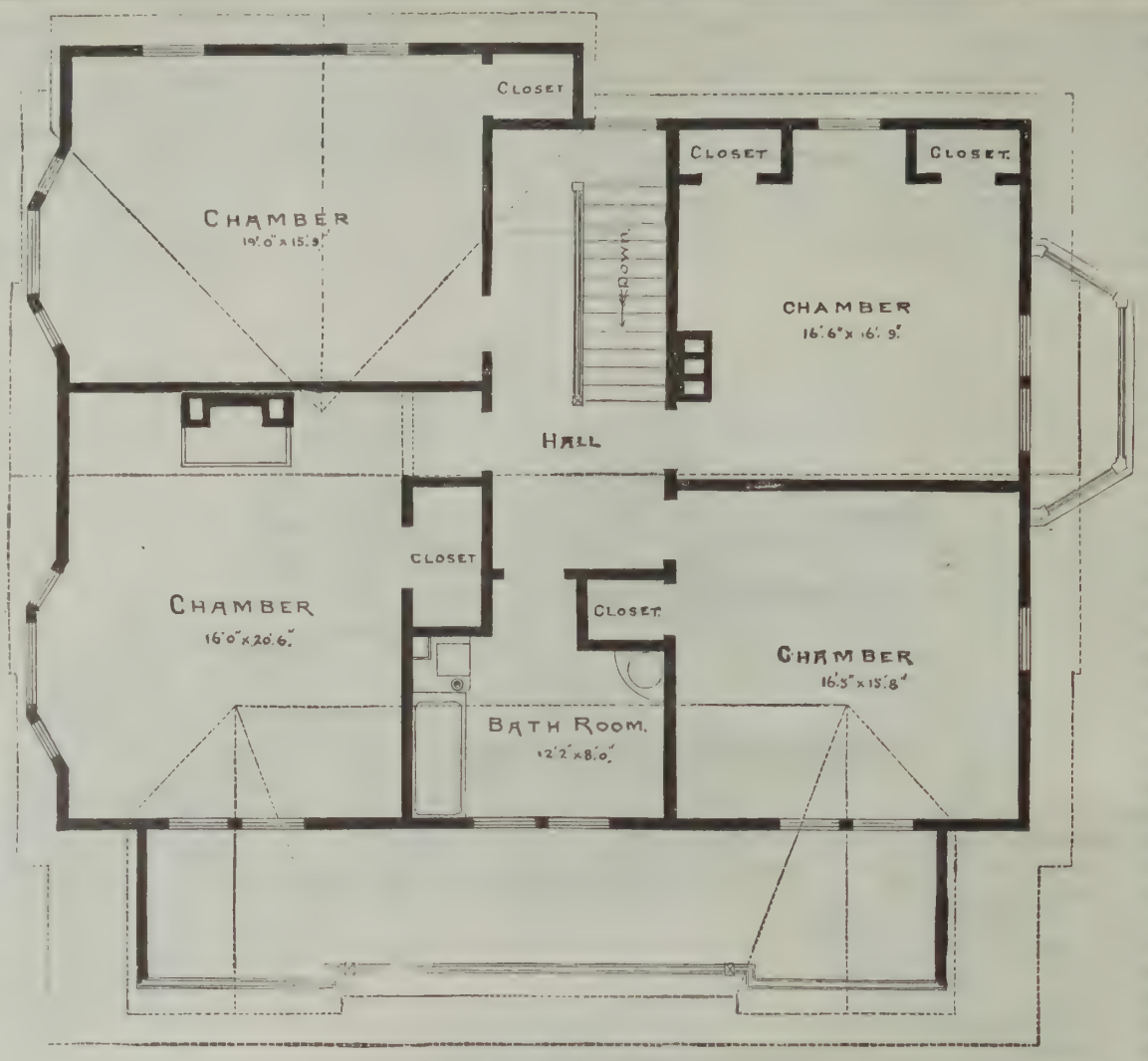
We give engravings of the houses of the workingmen of Mr. Krupp, colony of the "Three Linden Trees," Essen, Rhenish Prussia. The houses he builds for workingmen are said by Mr. C. D. Wright, who wrote a special report on the subject for the census bureau, to be among the most substantial in Europe. The houses compare well with the men employed in the celebrated steel works. Herr Krupp, by his system of employment, has the selection of the best mechanics in Europe. This system comprehends all the advantages to be found in model industrial establishments, including excellent tenements and gardens at low rents. All the houses in the "colonies" just outside the town are owned by Herr Krupp; in fact, he believes that he receives better results by owning everything, and by being able thereby to control the sanitary surroundings of the dwellings of his people. These colonies, each having its name, are laid out with parks, schools, churches, supply stores, etc.

The housing of single men at Essen is on the barrack plan, and is far below the American corporation boarding house style of housing our single operatives. But the inspectors prevent the men from crowding themselves in tenements. They expel workingmen who live in too small tenements.

The houses for families are quite good. On this page are engravings of a couple of types of the class. The price of a group of four houses such as is shown is $4 185. The price for one house, including the land, is $1,046 25. The annual rent of two rooms, with a cellar, varies from $20.93 to $25.11 in a house with two stories. The rent of a house in this group is from $37 20 to $41.85 a year. The refuse matter is taken by the peasants of the surrounding country, who use it as compost. The roof is covered with tiles. The exterior walls are of rubble stone or ashlar; the interior partitions are of wood. The window sills and stairways are of stone.

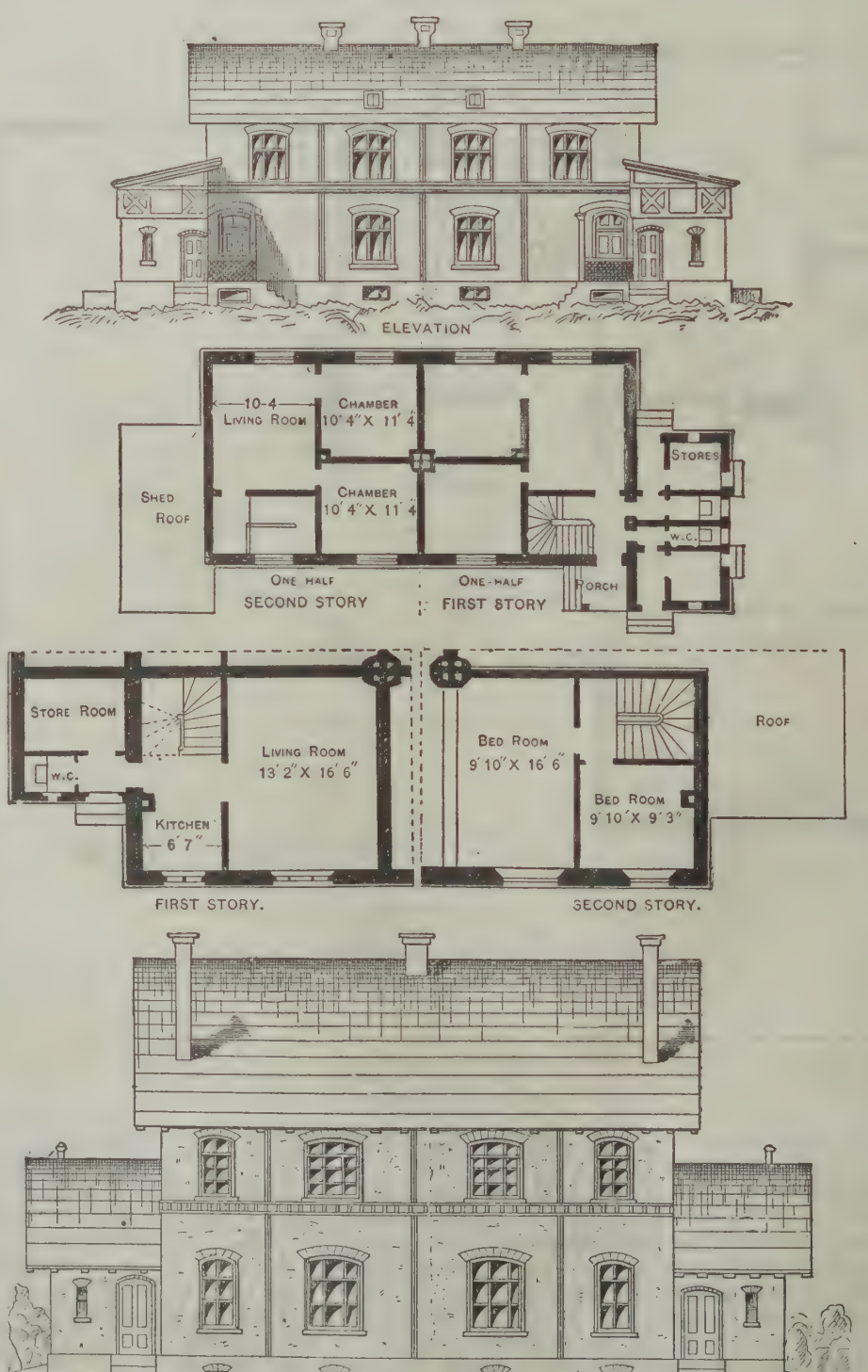
In 1876 Herr Krupp, to accommodate his workmen, constructed 3,277 tenements, which are occupied by 16,700 persons. On account of the rapid development of his works he has been obliged to build houses with stories. They are obliged to give every family a separate entrance.

The engravings also show a group of two houses arranged for four families. In this group the annual rent of a tenement composed of four rooms is $41.85. The employes of Herr Krupp pay their rent once in three months. The rent of the workingmen is regulated by reserves made from their pay, which is carried into effect every fifteen days. The rent of widows is paid by the benefit societies.—*Min. and Sci. Press.*



CHAMBER PLAN

A SEASIDE RESIDENCE.



WORKINGMEN'S HOMES AT KRUPP'S STEEL WORKS, ESSEN.

The Underpinning of the Great Yarmouth Town Hall.

In 1882 a new block of municipal offices and law courts was built at Great Yarmouth, partly upon but on three sides overlapping the site of the then demolished town hall of 1716. The new structure measured 132 ft. by 108 ft. by 50 ft. high to the parapet, with a clock tower 110 ft. high, the whole weighing about 5,000 tons, costing £30,000. Its architecture was modern Queen Anne, with mullioned windows, square headed below and circular at top. Its construction of red brick above string course, and red St. Bees stone facing at base, moulded plinth, brick parapet with ornamental stone cornice and fascia carved in relief.

The subsoil consisted of the gravel bank which the ocean deposited a thousand and more years ago, 16 ft. to 18 ft. of ooze, subsequently contributed by the three rivers and by riverside vegetation, surmounted by about 5 ft. of made ground, into which the trenches were cut for the concrete foundations of the new building. The river Yare and its wooden quay head were 70 ft. distant. The structure, which six years ago had its birth on such a site, gave early indications of unequal subsidence. This continued more particularly in wet seasons and at low tides, until in the year 1886 it apparently approached the limit of safety, and steps were taken to underpin that portion which had settled most, by the insertion of concrete blocks beneath the foundation.

The impracticability of removing the water from any trenches made for this purpose, without at the same time jeopardizing the building, led to this attempt being abandoned, as also was the proposal to widen the foundations by the insertion of wrought iron needles through the brickwork, and supporting them near the ground on the previously made, but not used, concrete blocks.

By November the west front of the building had sunk over a foot at its ends, and 8 in. at its center, and there were some ugly fissures in it, as well as in the north wall, accelerated by pumping away the water to insert the concrete blocks as before mentioned. The walls and tower had not only settled, but were leaning toward the river. The town council, therefore, resolved to demolish the western portion of the block, with the view of its being re-erected on more stable foundations. The cost of pulling down and rebuilding would have exceeded double present sum, as some obstructions would have been met with, and, of course, necessarily included rents for new offices, removal of furniture and fittings, commission, and contingencies. The work was to occupy about three years.

A scheme was then submitted to the town council by Mr. Duckham, of the Millwall Docks, engineer, in conjunction with Mr. Jas. E. Teasdel, engineer and surveyor, of Great Yarmouth, for preventing the further subsidence of the crippled portion of the block, and lifting the portions which had settled most to the level of that which had settled least. The proposal also included the straightening of the bulged walls. The prominent features of this scheme were:

First. Cast iron screw cylinders (those as adopted varied from 2 ft. 6 in. to 3 ft. diameter) placed at intervals of about 9 ft. inside and outside the main walls, and screwed down into the ballast, then filled with cement concrete.

Secondly. Double lines of wrought iron girders, I I, on top of the cylinders parallel with the walls.

Thirdly. Wrought iron needles 14 ft. to 16 ft. long, mostly 16 in. by 6 in., I, with a top table 12 in. wide, and averaging 8 ft. long, equal to width of the concrete under brick footings, passed through under this concrete foundation at intervals of about 3 ft. 6 in., and suspended at each end by two 2 in. bolts from the before mentioned I I girders—the insertion of these needles and the tightening of the bolts transferring the weight of the building

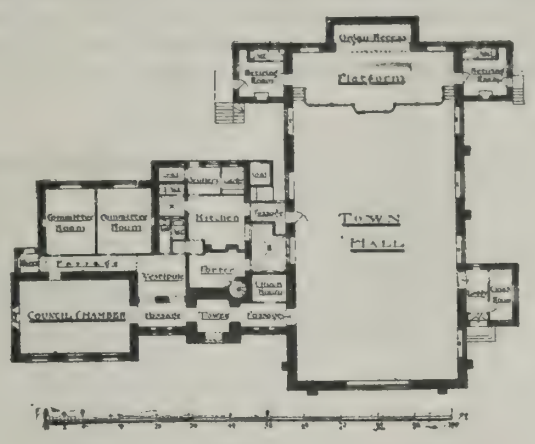
from the unstable ground on to the screw piles. The tower, weighing 700 tons, and having a base 20 ft. square, to be somewhat differently treated. Five special cylinders of 4 ft. 6 in. and 5 ft. diameter were proposed for this, to be placed as the adjacent walls permitted. The eastern and western walls of the tower, *i. e.*, those without openings on the ground floor, to be each sandwiched between a pair of massive lattice girders below the floor level. Needles of I I section to be inserted through the walls and through the girders, and bolted up to the upper member by four 2 in. bolts at each end.

This proposal of Messrs. Duckham & Teasdel was adopted, after severe criticism and opposition, and a contract for the chief portion of the work was entered into by the town council with Mr. Thos. Gibson, of Westminster Chambers.

The first cylinder was pitched at the end of May last, and the work was completed in November. The whole western portion of the block and tower are supported on a sort of gridiron of wrought iron joists, suspended from the girders which rest on the pile tops. The suspending bolts have nuts at each end, and 12 in. of thread. By a systematic and gradual screwing up of some more than others, the low parts of the block have been lifted to the higher level, the unsightly curves have been taken out of the building, and the tower set upright by raising its lower side.

The ground has been cleared to a depth of 2 ft. under the old concrete, and the trenches have been filled in with cement concrete, forming one mass, incasing the pile tops, girders, and bolts, thus forming a new foundation 7 ft. wider than the former one, irrespective of the support given by the immovable screw piles. The tower girders have been similarly concreted. The replacing of the floors, making good the damaged masonry, and refitting in general are now being proceeded with. The damaged places in walls are being cut out through the entire thickness, the wall and windows adjoining the tower being rebuilt all in Portland cement.

The subsidence in walls of main hall and tower during these operations was considerably less than anticipated, being only nominal, and this was rectified by the lifting process. What settlement did occur during the progress of the works was chiefly due to the flooding of the trenches by a high tide rising through



PLAN OF TOWN HALL OR CHURCH.

placement when underpinning was being carried out, and more particularly so in the lifting.

The effect of screwing down the piles reduced the rate of settlement of the building by consolidating the adjacent ground. The western portion of the building and tower are now sustained by a better foundation than any other structure in the neighborhood, being in reality upon what was in point of fact the old Yarmouth sea beach, composed of sand and coarse shingle.

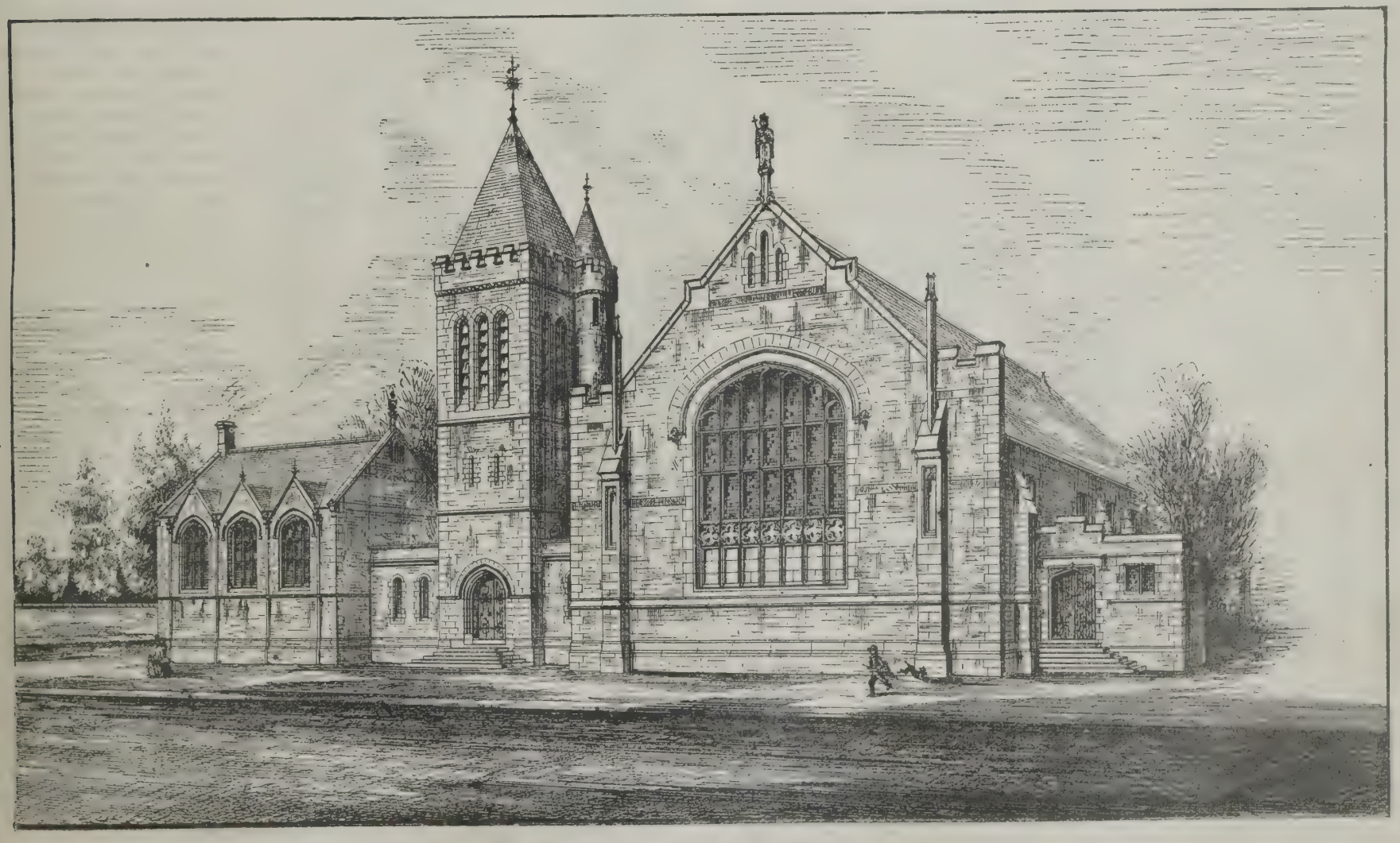
Mr. Teasdel, who at the first onset, from his knowledge of the locality, had intimated that the new hall would be insufficiently supported, had also, when settlements first occurred, advocated the underpinning in a similar manner as now carried out.

The work was carried on from 6 A. M. to 8 P. M., sometimes later, and, considering the obstacles met with, no time has been lost. The whole was ready for reoccupation in March, 1888. The time thus occupied was ten months, against three years. Moreover, the inconvenience of moving officials and courts to new quarters has been avoided. With the exception of the accountant and harbor master, the municipal business, including that of the quarter sessions, magistrates, town clerk, surveyor, etc., has been continued without interruption in the eastern portion of the building.

It is worthy of note that the total cost of the work and its contingencies will be well within the estimate, £8,250.—*The Architect.*

TOWN HALL OR CHURCH.

We give herewith, from the *Building News*, a view of new buildings at Launceston, erected for the purposes of a town hall, but which with very slight modifications might be adapted for church purposes. The main hall has seats for 800 persons. The roof is of the hammer-beam construction, and the acoustic properties of the room are excellent. The buildings are of stone. Architects, Messrs. Hind, Ogers & Peter.



TOWN HALL OR CHURCH.

A Relic of Old London.

By the demolition of the house No. 21 Austinfriars, which is about to take place, a very interesting relic of Old London will shortly pass away. This house is the last of the old mercantile residences of the City of London, and is one of the few links which connect the London of to-day with that of the merchant princes. It stands on what was formerly part of the garden of the priory of the St. Augustine monks. The priory was confiscated by Henry VIII. and presented to the Earl of Winchester and others; but the garden remained unaltered, and it was probably not until some time between the years 1660 and 1670 that the house in question was erected. The house, which has been preserved as it was at that time practically intact, is to be seen on the map of London which was prepared by four commissioners appointed to make a survey of the City after the great fire. It is a large and substantial building, lined throughout with solid wainscoting; its apartments are roomy and convenient; and its staircases are broad and carved with curious antique designs.

The garden and all the original offices have been preserved, and the counting house, the yard, the coach house and stables, the bake house, even the old well and pump, remain as they were at the time when the house was built. The present owner is Mr. John Fleming (of the firm of Robinson, Fleming & Co.), whose title to the premises, dating from before the year 1690, is derived from a Mr. Hermann Olmius, a Dutch merchant who resided and died in the house. The descendants of this latter gentleman leased it to a Mr. Minet, whose name appears in the London directory of 1788, and who was a merchant and banker. It was believed that Mr. Minet had extensive dealings with the Continent, and he is reported to have been the confidential banker of Napoleon I. There is a special strong room in the basement of the house, which from its character is supposed to have been used for the purpose of concealing secret valuables. The next tenants of the house were the important mercantile firm of Thomas, Son & Lefevre; and for the last thirty or forty years it has been in the occupation of the present owner. The house has been so carefully preserved that it retains all its original old fashioned features, which, together with the fact that it is the last house of its kind in London, invests it with an interest to which the more modern buildings surrounding it cannot lay claim.

Sawdust and Shavings.

Of all mill offal, sawdust and shavings are considered nearly valueless in localities remote from populous centers. The common impression is, even in a city like Chicago, that the detritus left by the saw and planing machine is almost worthless. But such a notion is very erroneous. Shavings and sawdust are commodities as marketable in Chicago as wheat or coal. In fact, at the present time, they are remarkably quick-selling kinds of property. There is not enough of either dust or shavings to meet the demand. Dealers are actively engaged in drumming among the mills for enough to supply their customers. This renders the market speculative, and gives the dealers a chance to realize profits on sales. The scarcity of dust and shavings is so pronounced that the mill men have become fully aware of it, and are now putting up prices on the dealers and consumers. Sawdust has be come so precious that it suggests that other kind of dust of great value with which creditors are required to "come down." And there are different kinds and grades of sawdust, as well as of other products. The softer the wood out of which dust is made, the less valuable is the dust. For instance, in the summer, when the mills are all running, pine dust can be had in any quantity at $1.50 a load; in the winter prices stiffen, and go up to $3 a load. Hardwood dust, even if made of the meanest kind of timber, always commands high prices, ranging from $5 to $7 a load; ordinarily, though, it has been sold in Chicago as high as $10. A load of hardwood sawdust is about two cords. So it will be seen that the purchaser gets a large quantity for $5 or $7, as the case may be. This suggests that hardwood dust at $2.50 a cord would not be very expensive fuel. If Smith's compressor could be brought into requisition, and the dust hammered into blocks, it would make excellent and economical fuel. Hardwood dust is used for smoking hams, because it emits a sweet smoke, and does not flare up into a blaze like wood, and is used in large quantity by the packers. In talking about hardwood sawdust, one mill operator on Twenty-second street, Chicago, was set to thinking by the suggestion that it would almost pay to work all cull hardwoods, of the cheaper kinds, into sawdust. He said the suggestion was worth considering, and he did not know but he would try the scheme.

The shavings from planing mills are largely sold to the lime makers. The Chicago Lime Company, whose kilns are at the big quarry, near Indiana street and Western avenue, contracts for the shavings of several planing mills. They are used for burning lime, being much preferred to cordwood. Shavings are also extensively used for stable bedding, as are large quantities of sawdust. Dust is the favorite carpet for liquor and beer saloons. It is a ready absorbent of filth, deadens the sound of treading feet, and softens the fall of the man who has let his thirst run away with his judgment. But sawdust on the floor of a saloon indicates a low rank; the swell liquor house floor is sanded, in consonance with the amount of "sand" that is necessary to pay for high priced drinks. When a man steps on the sawdust of a saloon, he may know that he can get a whisky for a dime; if his foot grates on the sand, he may conclude that his snifter will cost him 15 cents. Thus even the dust under one's feet in a rum shop indicates rank and degree.

Immense quantities of sawdust are used in ice houses, fish markets, and in every industry where it is necessary to use ice. For some reason not explainable, there is a scarcity of sawdust for ice house purposes this winter. A lumber commission house, in December, received an inquiry for a car load of sawdust from a man in Wisconsin. He evidently thought that a Chicago lumber dealer could furnish anything made of wood, even to the chewings of the saw. A box maker of Chicago recently received an order from Peoria for several car loads of dust, thinking that it could be furnished immediately. But the box maker was unable to meet the demand

The shaving trade is largely controlled by regular dealers, of whom there are half a dozen or more in Chicago. They contract for shavings at the usual rates of $1 and $1.25 a load, and peddle them out for kindling, etc. Some of the planing mill owners burn their shavings under their boilers in place of other fuel; but the shaving dealers consider this a great waste of valuable material. One dealer exchanges soft coal for shavings; that is, he furnishes coal for generating steam in a mill if he can be allowed to cart away the shavings that would otherwise be burned.

The planing mill and box factory owners derive a considerable revenue from the sale of shavings and dust. One receives $1,200 a year; another, $2,500; a third, $1,700. A single box factory disposes of $500 worth of kindling wood every month. The sale of the offal of planing mills and box factories is a great help to the operators in making a profit out of their business. As a general thing they complain bitterly about low rates for mill work, and the lack of resulting profit. Some of them say that if it were not for the sale of dust, shavings and kindling wood, they would have to bank fires and quit operations; but this is doubtless drawing it rather strong. However, such is the value of shavings and sawdust that it has led shrewd lumber dealers and planing mill owners to think that saw mills could be successfully run in this city. This scheme would involve bringing in logs by lake, either in rafts or scows. The manager of a large wholesale yard here gives it as his judgment that the sale of offal from a mill located in, or conveniently near, this city would pay for cutting and bringing in the logs.—*N. W. Lumberman.*

COUNTRY RESIDENCE OF MR. KURTZ—F. GEBHARDT, ARCHITECT, ELLWANGEN.

Dry and Damp Rot

has proved itself ruinous to many valuable edifices and has been the cause of many serious accidents. The ends of joist are soonest affected by it, and the process of destruction has often gone so far without a suspicion of anything wrong that when burdened with even a slight additional load, they are ready to break off by the wall.

Stagnation of air, as behind a wainscot, under a floor, or where beams are confined into walls, is the chief cause. Another cause is insufficient drying of the timber itself.

When timber is confined so that no air can get to it, a fermentation and chemical change takes place in the albuminous constituents of the wood, providing a soil for the vegetation of fungi, the mycelium of which diffuses itself through the substance of the timber, destroying its texture and reducing it to a fragile or even a friable mass. The production of fungi takes place with unusual rapidity when an acidulous condition of organic substances is produced. Their growth is also greatly aided by moisture and exclusion of light and fresh air. To prevent this fermentation various processes of filling the pores of the wood with chemicals have been devised. M. Paulet has enumerated no less than 173 different processes, all of which have for their object the arrest of fungoid growth, and seek to accomplish this by two main systems, one of which consists in impregnating the wood with a solution of metallic salt, such as corrosive sublimate, chloride of zinc, or sulphate of copper. The action of salts is purely chemical, and as they are introduced in watery solution, it is evident that subsequent exposure to dampness tends to dissolve them and leave the wood unprotected. Creosoting, the other process, while producing the same result chemically, is claimed, on account of its oily nature, to secure dryness. But without the use of any such means we have abundant evidence that well seasoned timber, if kept dry and where draughts of fresh air can reach it, will remain unassailed by fungi for many centuries. England contains structures of which the timber is known to be 1,000 years old, and wood in a perfect state of preservation was brought by Lord Elgin from the frieze of the Parthenon, where it must have been placed more than 2,000 years ago.

A Residence of Moderate Cost.

Detail of Staircase

Section of Sliding Front & Vestibule Doors

Section of Front Doors.

Section of 2nd Story Doors.

2nd Story Door

1st Story Door

Perpendicular Section through House

Stair Pedestal

A $10,000 Residence.

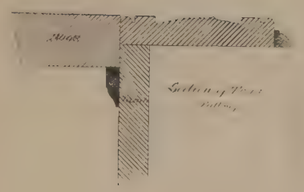
Section through Piazza

Section of Window Frame

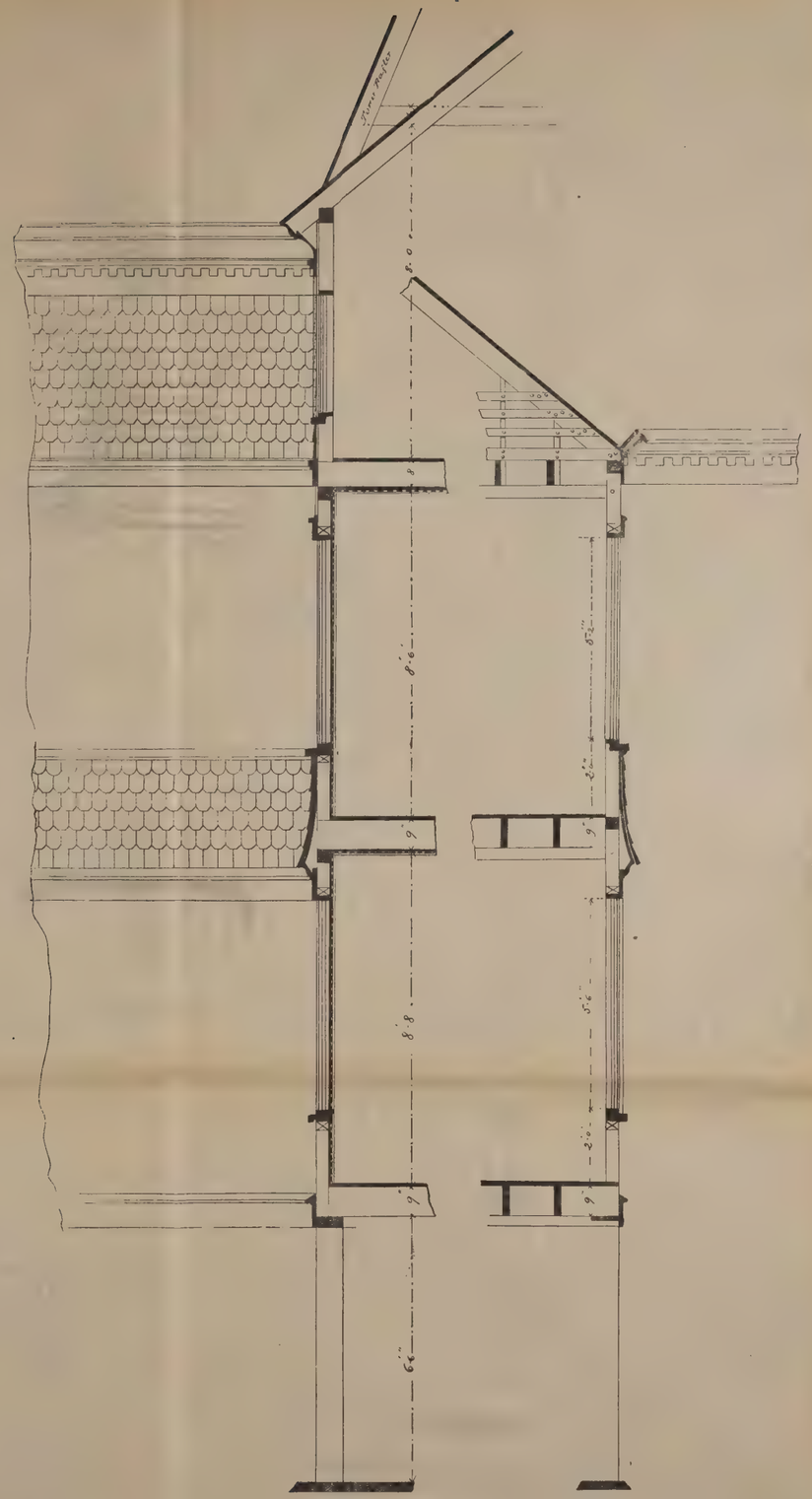
Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for April, 1888.

Elevation & Section of Parlor Mantel

Section & Elevation of Dining Room Mantel

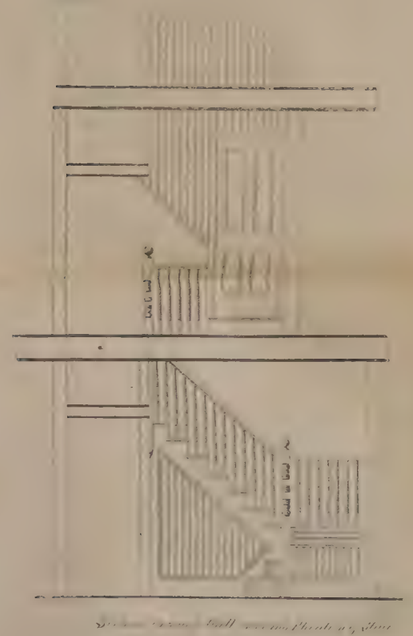


Section of Rail

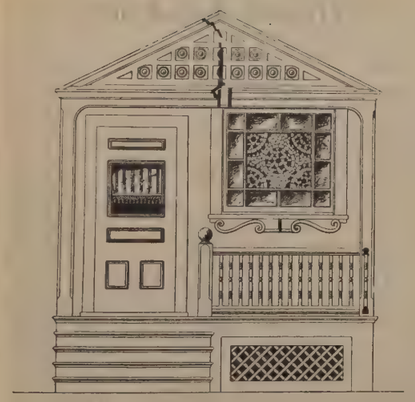


Section through Side of House. Section through Front.

Floor Plan

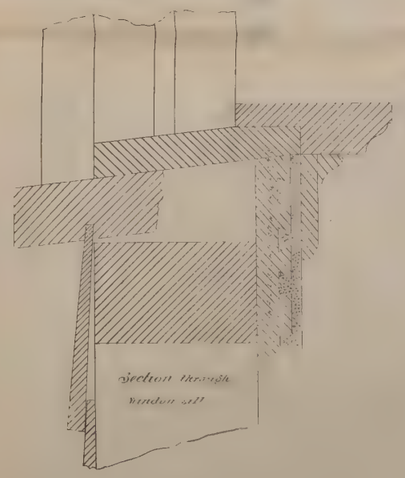


Details of Stairs, Hall and Plan of Floor



Elevation of Porch

A Cottage for $1,900.



Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for April, 1888.

A Cottage for $1,900.

Supplement to the Scientific American-Architects and Builders' Edition, April, 1888.

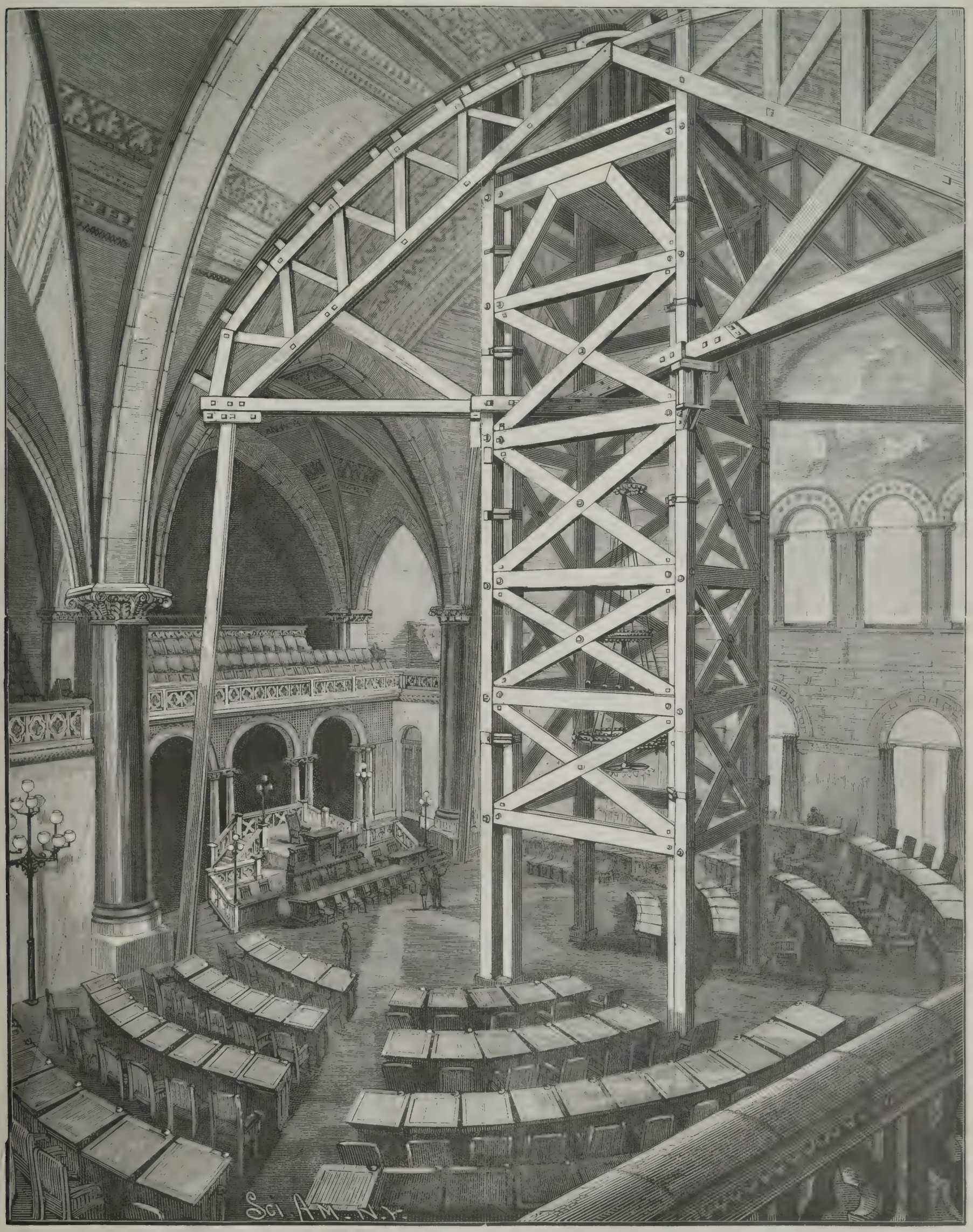
THE CAPITOL BUILDING, ALBANY, N. Y.

Probably the most expensive and gorgeous State Capitol building in this country is that at Albany, N Y., upon which almost fifteen millions of dollars have already been spent, and it is not yet finished. It is a magnificent structure of noble design. But there are evidences of bad work, poor engineering skill, and lack of proper supervision during the construction of some portions of the edifice.

The Assembly chamber is one of the noblest auditoriums, grand in general appearance. Its ceiling of stone is supported on groined arches. An unfortunate settlement of the adjacent walls, which has for some time been going on, has of late made such further progress as to endanger, as was believed, the lives of the members of the Assembly when in session. The ceiling was regarded as liable to fall at any moment.

Immediately upon the assembling of the Legislature, early in January, the members began to be annoyed at the renewed reports in regard to the unsafety of the ceiling. Their fears continued to grow upon them, until finally they moved into the Assembly parlor and voted an appropriation to allow the temporary "shoring up" of the vault by the Capitol Commissioner, Mr. Perry.

The Assembly chamber has extreme dimensions of 140 by 84 feet. It is, to use the terms of Gothic' architecture. a nave of five bays with an aisled transept. The extreme length is shown in the gallery floor and at the ends of the nave. Each of these extreme spaces is a public gallery. What would be the last bays of the aisles on either side of them are walled out of the room altogether. The spaces under them are vaulted lobbies. The squares at the corners of the central space are also separated from the main room on the first floor, at the Speaker's end, by a solid wall, and at the entrance end by columns carrying a stone screen, and each contains a gallery. The Assembly chamber proper is thus confined to the central transept, including the bays at either end, in one of which the Speaker's desk, shown in our engraving. is placed. The space bounded by the columns is 45 by 55 feet, nearly, and the keystone of the vault over it, the highest point of the room,



THE CAPITOL BUILDING, ALBANY, N. Y.—TEMPORARY TRESTLE FOR SUPPORTING THE CRACKED CEILING.

is 62 feet from the floor. The ridges of the vaults are not horizontal, but have a rise in the central vault of three or four feet in the center. There are no ridge ribs and no wall ribs, the coping abutting directly upon the walls. The shafts of the four columns which support the central vault are four feet in diameter, composed each of three drums of red Connecticut granite, polished. The capitals and bases are of Westchester marble. The walls and cells of the vaults are of Ohio sandstone, with ribs and arches of Dorchester stone. The nook shafts of the windows are of brownstone from New Jersey, with capitals and bases of Ohio stone. The hood moulds of the windows are of brownstone, the voussoirs of Ohio stone, the archivolts within them, and the impost mouldings, of Dorchester stone. The moulding of the arches and ribs of the vault, and of the jambs, wall arches, and other features, is bold and simple in character, rather than delicate or complicated, and the decorative carving is throughout highly conventionalized from natural types in design.

The carved enrichment of the Assembly chamber is abundant, and incised arabesques are freely introduced, as well as modeled carving. The color decoration is everywhere a part of the carved decoration. Each groin of the ceiling bears two belts of decoration, one almost at the ridge, the other not far from the springing, which follow the line of the courses. The ornament in the upper belt, fifty feet from the spectator, is very bold in design and cut; the lower belt subordinate in all respects. The stone is excavated to the depth of some inches, and the ground filled with vermilion or ultramarine, the ornament edged with gold. The furniture of the room is mahogany. On the north and south walls of the chamber are the famous frescoes "The Discoverer" and the "Flight of Night," by William M. Hunt.

The chamber, as described above, is not the one that was originally designed. The ceiling of that one was to consist of panels of cast iron at a height of forty-two feet from the floor. In 1875 the Legislature abolished the Board of Capitol Commissioners and placed the work in the hands of the lieutenant-governor, the attorney-general, and the auditor of the canal department. When it was proposed to change the entire form of the Assembly chamber and load the weight of the ceiling upon the four great columns, the original architect, Mr. Thomas A. Fuller, resigned; and the board put Mr. Leopold Eidlitz and the late Mr. Richardson in charge of the work. Mr. Eidlitz proceeded to construct the Assembly chamber as it was finally built.

There appeared to be no feeling of insecurity until 1881, when a resolution asking for an investigation was defeated in the Senate. In 1882 a report was made to Gov. Cornell by a special commission consisting of W. P. Trowbridge, Chas. Babcock, and George B. Post, who reported that the workmanship of the building was, as a general thing, very thorough; but in the Assembly chamber they found that the four great columns were loaded to the extreme limit of safety; that the stone of which the ribs were constructed was not uniform in quality or strength; that the side vaults had a tendency to rise; and that the main arches were in good condition, although the transverse thrusts had been taken up by iron rods at points above the crowns of the main arches. Therefore the commissioners, being uncertain as to whether the columns had settled as much as they would, recommended that the stone vaulting be removed and be replaced with wood, the stone ribs still remaining. Mr. Eidlitz asked that he might repair the broken ribs at his own expense, and nothing more was done, except to allow him to do so.

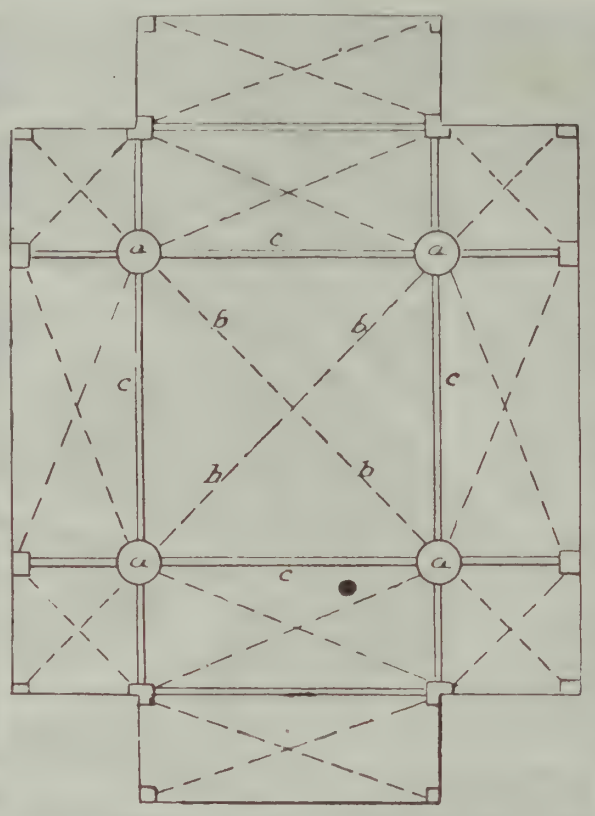
Examinations at that time showed very large cracks through which the room below could be seen. The Assembly, therefore, was obliged to meet in the room beneath for a few weeks in the early part of the year 1883. When these repairs were concluded, the Assemblymen sat under the ceiling for four years without anything more than an occasional attempt to have some one investigate and report upon the alleged danger. By 1887, however, there was alarm. An engineer was employed to make a thorough examination. He reported there were many new fissures in the ribs, and the ceiling must come down and be replaced with a lighter one of wood. This report was not made until the end of the legislative session. Hence nothing was done during that year.

The commissioners appointed to make a preliminary examination, early in last January, were John Bogart, State engineer, Richard Upjohn, architect, and Thomas C. Clark. Early in February they made a report which contained, among others, the following statements: "We went up to the top of the ceiling, and found there had been many serious movements of the stones of the groined vaults, owing to the vaults and ribs not acting together. This has caused cracks at the joints, in some cases of considerable length. In one place, at the apex of the ceiling, the Assembly floor can be seen through the crack.

We found the main vault in two places had settled three inches below its original level. All the main ribs which support the central vault were found to be cracked and shattered near the circular keystone. In one of the ribs we found a stone three feet long split from end to end in strips. By the side of another rib was a spall, split by pressure, 10½ inches long, 7 wide, and 3½ thick. Its defect was not due to the material. There is clear evidence of sound sandstone split by a pressure many times what it had been calculated to sustain. The whole ceiling is in a dangerous condition, more or less cracked, showing signs of unexpected pressure. As the ribs originally were none too large to resist pressure, in their present reducing condition they are still less able to do their work. A time must come, and that we believe very soon, when without warning one or more of these overtaxed rib stones must give way. When that happens, the whole ceiling will fall."

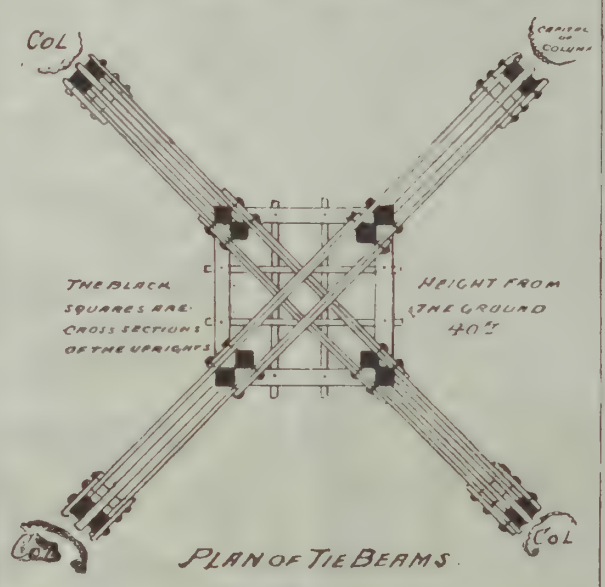
A more thorough examination established the fact that the ceiling is not in a state of equilibrium, that is to say, the excess of pressure in one part, as at the base of the arches that spring from the southeast column, tends to press upward all the ashlars—or what is called the "vaulting"—on whatever plane it may be laid. There was formerly just as much trouble with the rising of the arches that spring from the other three pillars; and the central dome showed a very bad disposition to rise, which was only corrected by placing upon it many tons of pig iron to load it down. The arches that spring from the four great columns are surmounted by walls that reach a level of five feet above the respective keystones. The walls are carried beyond the columns into solid walls beyond. Just above each of the four great arches that connect the columns (and embedded in the solid masonry) there run straps of iron 3 inches broad and 1½ inches thick. Four of these straps are laid side by side, thus forming tie rods, which are anchored in the solid wall beyond. Thus each of the four columns is crossed at right angles by tie rods some distance above its capital. This will be shown more clearly by the accompanying section of the two east and west walls. The dotted lines at *d* show the hidden granite arch that receives the thrust from the main arch and keeps the four great columns from being pushed outward. As the tie rods expand in the summer, the arches drop a trifle. When they contract with colder weather, the arches will not rise, but spalls will chip off. This process has been going on for years, and it has been a source of great danger. These spalls, which fall to the floor, almost invariably appear when there is a considerable change in the temperature outside—in October and November. The staging that is in place now enables the visitor to examine closely the under surface of the ceiling. The dropping of the central keystone has pulled the ashlars away from the west walls, and has left great gaps, which were filled four or five years ago. At the same time many defective places caused by the dropping of spalls were pointed, so as not to appear from the floor. A closer examination shows that the ridges along the main vault are so thoroughly crushed that it is a wonder the broken stone did not fall long ago. The diagonal ribs of the great vault show many cracks, which prove they were made of too light material. The fact is, they should not only have been made of better material, but they should also have been three or four times as large.

The Capitol Commissioner, Mr. Perry, saw at once that these diagonal ribs must be supported. In this he did not agree with some who had thought that the ribs connecting the four great columns should be

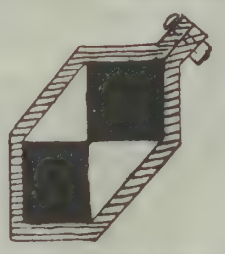


a. The four columns. *b*. The diagonal ribs that need support. The light ribs are all dotted. *c*. Heavier ribs.

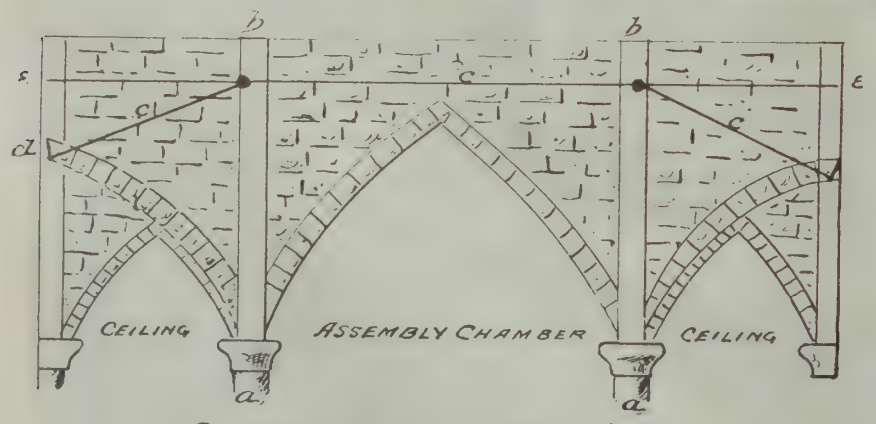
PLAN OF ASSEMBLY CHAMBER CEILING.



PLAN OF TIE BEAMS.

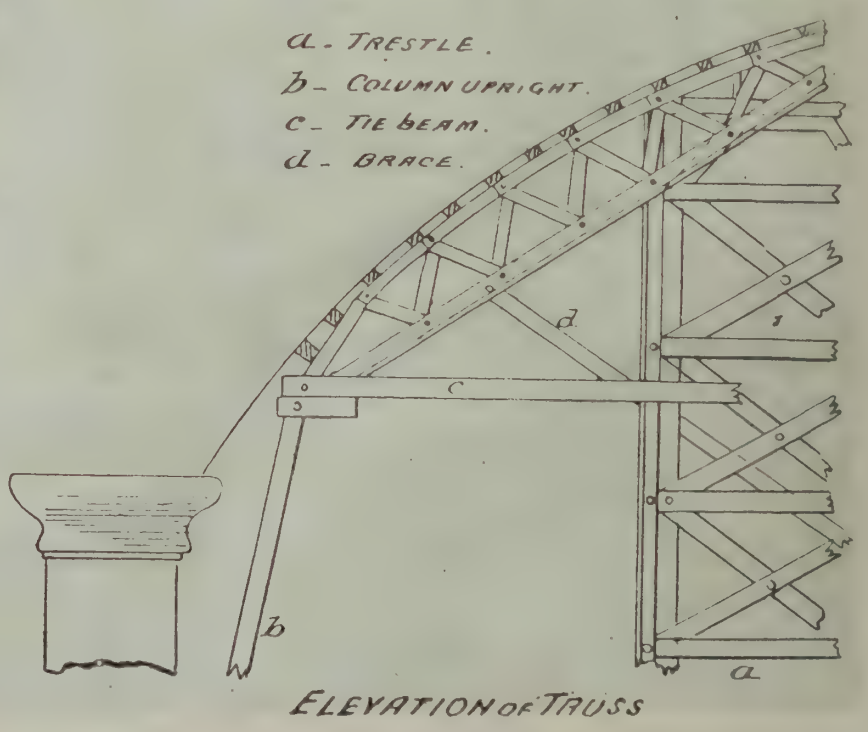


How bolted (cross section).



SECTION OF THE EAST & WEST WALLS.

a. Two of the great columns. *b*. The cross walls, north and south. *c*. The tie rods. *d*. The granite arch (hidden by a veneering of sandstone) holding the anchorage of the tie rods and receiving the thrust of the main arch. *e*. Extra tie rod in north and south walls.



ELEVATION OF TRUSS

strengthened. Mr. Perry's first movement was to cut through the floor in four places near the center of the room, so that he might strike two columns in the floor below; and, for his other two foundations, go to the solid bases one story lower. Thus he had a parallelogram 18 feet one way and 12 feet the other. He placed on the corners sticks of Georgia pine 12 inches square as the uprights for the trestle. These sticks were reenforced by sticks of the same size placed edge for edge toward the interior of the parallelogram—the two being bolted by straps of iron. The trestle was continued all the way to the keystone. Excavations were made about the bases of the four great columns and heavy foundations of wood were laid, on which two uprights (each 12×12) were placed, with the inclination toward the great trestle in the center. When these uprights had passed above the capitals of the columns, they were met at right angles by great tie beams, which braced them into the central trestle. Having thus prepared a strong framework, it was a comparatively easy matter to construct four trusses running from the top of each column upright to the nearest corner of the central trestle. In the placing of the trusses, a chord was first run in a straight line. Then a rib, in very small sections, was built along in the curve about 6 in. for the stone rib of the ceiling above. The last of the work was to connect the ribs and the chords by the struts, or cross pieces.

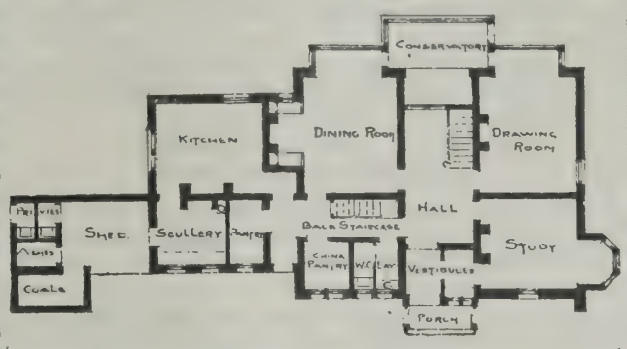
The whole work has been an undertaking of great difficulty. It supports the ceiling so that there is no possible danger, and, at the same time, the support is so permanent that it can be used when the ceiling is finally removed. The chances are that it will be succeeded by one of wood or of iron. In either case it is probable that the pointed Gothic arches will not be repeated; but that Romanesque arches will be used, in harmony with the windows and doors, thus lowering the height of the room from 12 to 15 ft., and much improving its acoustic properties.

The Rose Acacia for Walls.

This beautiful shrub is so seldom seen trained against a wall or trellis, that it must be inferred that it is not commonly known what a charming effect it has when so grown. Its branches are so brittle that it can all the more be recommended for walls or trellises. I once saw a rose acacia in full bloom in early summer against a high wall, which it completely planted against a projecting buttress, which it will adorn in a charming way, and may be kept within bounds by hard pruning. This is one of the many hardy flowering shrubs suitable for covering walls, and full advantage is certainly not taken of it. The rose acacia is a common shrub in tree nurseries, and is inexpensive. There are a few varieties of it, those called macrophylla, spectabilis, and rosea being the best known. The type, however, is so beautiful that one hardly needs an improvement upon it.—*W. G., in the Garden.*

A VICARAGE.

This vicarage has lately been built on a site given by the Earl of Durham, who also contributed largely to the church building fund. The house is built of red



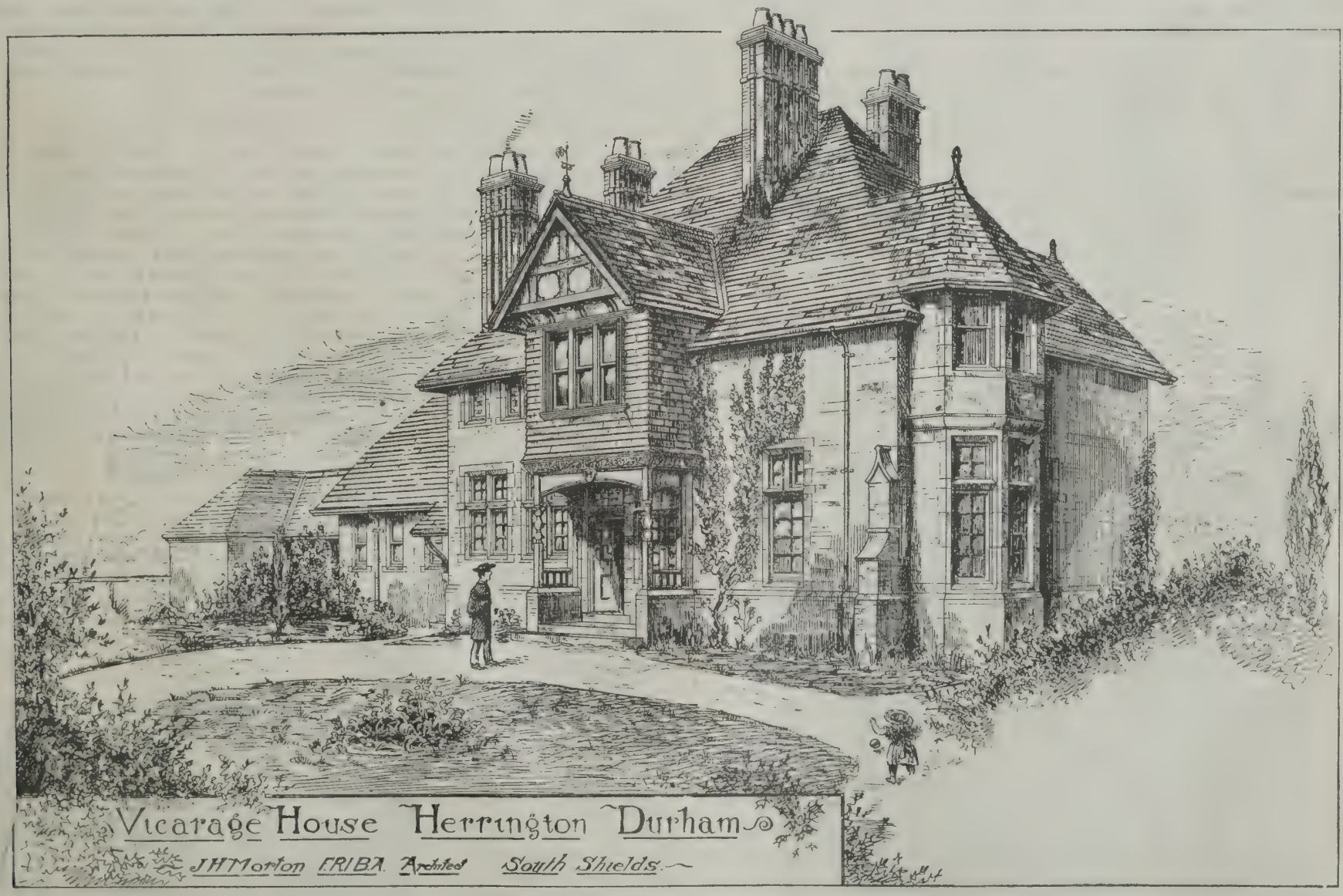
bricks, with stone dressings, and the amount of the contract was $7,200.—*Building News.*

Moss for Plants.

For the last fifty years at least there have been periodical revivals of this material as a substitute for soil or loam in the cultivation of plants. During all that period, I do not suppose one really practical gardener in a thousand has ever been led to substitute this just now much-lauded material for soil. So far as I know, no chemist has ever tested or recommended fertilizing moss, and it is not my intention to say one word against it; but at the same time I may here point out that after having tried several samples of fertilizing moss, as purchased by me in the open market, I find it useful and convenient for certain purposes in plant culture. But I can say more. After having tried an equal bulk of ordinary wood moss—that is to say, two or three of the most common kinds of hypnum—I find it fully equal to the fertilizing moss of the shops. In a word, while acknowledging the convenience and usefulness of the trade article, I have obtained precisely the same results from the wild wood moss, which many, if not most, people can have for the gathering. I have for years used common wood moss for covering the soil in pots containing plants used for the decoration of dry, warm, gas-lighted rooms, and with the best results, as not only does the moss prevent evaporation, but it exhales moisture, and so to a certain extent counteracts the aridity of fire-heated and gas-lighted apartments. As I have said, no professional gardener would for a moment give up sound fibrous loam and try to grow his plants permanently in fertilizing moss. But there are always people of the amateur class who, knowing but little of the principles or the practice of plant growth, will, like the proverbial drowning man, catch at all the floating straws and other *debris* which promise to float them out of their plant-growing difficulties. Against their purchase and utilization of fertilizing moss I have nothing to say. They can please themselves in the matter, but I have fairly proved by direct experiment that common green wood moss is equally efficient, and under some conditions of culture even more so. Soft wooded plants generally delight in wood moss, and their roots ramify into it in all directions, especially in warm plant houses. The moss should be pressed tightly into the pots, and as the plants root freely through the moss a little weak manure water may be applied with advantage. Cow manure and soot in a bag sunk in a barrel or soft water tank will yield a good quality of this "fertilizer." Nearly all bulbs, such as hyacinths, narcissi, etc., do well under common moss and manure water treatment, and it is especially convenient to use in the filling of temporary flower stands, window boxes, and jardinieres of various kinds. It is not better than good potting soil, but it is lighter, and so in this way often more convenient for such temporary uses.

Cuttings of nearly all kinds of plants root very quickly in a layer of wood moss if it is laid on any moderately heated surface and kept constantly moist. Even nepenthes root freely if the base of the shoot or cutting be placed through the hole in an inverted flower pot filled with hypnum moss and placed on a gentle bottom heat in a close case or frame. Some years ago there was a great outcry made in favor of sand and water as a medium in which to root soft wooded cuttings, but wet moss is, I believe, a more certain and reliable material. Roots formed in water often rot away when placed in cold, wet soil, but moss rooted cuttings are much more likely to succeed, there being less disparity in the density and moisture of the rooting medium.

Those amateurs who are on the constant outlook for royal roads in floriculture may rest fully assured that fertilizing moss is not one whit better as a rooting medium for plants than is the common green moss of the woods.—*Veronica, in the Garden.*



Reappearance of a Submerged Chinese City.—The city of Naiyen, north of Ningpo, which was submerged about one thousand years ago, has recently been exposed to view, and a number of vases, plates, and other utensils of the Sough dynasty have been recovered by the natives.

WOOD'S PATENT EXTENSION PLUMB AND LEVEL.

This improvement, which was lately patented, greatly enlarges the scope over the usual form of level, making it available for leveling lengths of 100 feet or more and for shorter lengths without the straight edge commonly used.

This is accomplished by providing sight pieces working automatically at the ends, whereby the line of sight may be extended indefinitely.

WOOD'S PATENT EXTENSION PLUMB AND LEVEL.

When not in use, these sights are depressed flush with the surface, and by pressing buttons in the sides of the level, the two sights are thrown into position. The sights are accurately adjusted, and may be relied upon to extend the horizontal line to the required distance with accuracy.

Tower & Lyon, 95 Chambers Street, New York, are the sole manufacturers.

The Painting of Iron Roofs.

Mr. J. G. Battelle, secretary of the Cincinnati Corrugating Co., in writing upon the subject of metallic roof painting, insists that this work must be done more thoroughly, saying that no effective substitute has ever been discovered for linseed oil as a vehicle for pigments, in effectiveness and durability, especially for exposure to weather. A good paint must be both hard and elastic. It requires hardness to prevent abrasion and wear, and elasticity to prevent cracking from expansion and contraction. Nothing but linseed oil will give these qualities, for the best pigments add very little to the effectiveness of paints. Many pigments used are in themselves the reverse of protective, and are really destructive to both the vehicle and the material which they are supposed to protect.

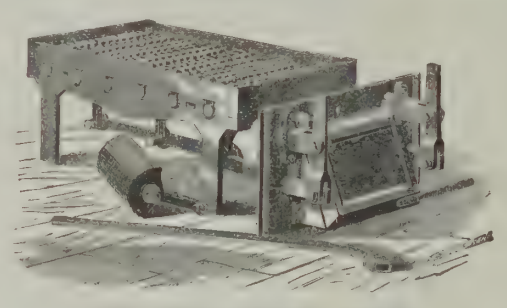
The matter of protecting sheet metals by painting is becoming yearly of increased importance, owing to the rapidly growing use of sheet metal in corrugated and other forms of sheet iron, in the improved shapes now manufactured for covering roofs and sides of buildings, for fire-proof lathing, for arches, etc.; and experiment has demonstrated that there is no better pigment for metal than a good iron ore ground to an impalpable powder. To be most thoroughly effective, the pigment must be intimately incorporated with the vehicle, which can best be done only by grinding them together in a stone mill, by steam power, and not merely mixing them in a tub or vat by hand, as is done in some of the cheap paints.

All buyers of sheet metal roofing, etc., should assure themselves—first, that they are buying of a thoroughly responsible firm; second, that such concern uses no vehicle in its paints but pure linseed oil, grinding all materials used for paints together. As rust is liable to be incurred in transit if the material is unpainted, the material should be originally painted at the manufactory. This original painting is, by far, the most important, for if it is defective, the work will require repainting sooner; but no matter how good the subsequent coatings of paint are, they cannot be effective if founded on an original coating which has commenced to crack or peel.

In modern fire-proof construction, iron laths are largely used, and the Cincinnati Corrugating Co. is in the field this spring with an improved style of corrugated lath, for which they report having made extensive contracts in the South and Southwest, and in connection with government and other large public buildings all over the country.

THE REED ROCKING GRATE.

This is connected outside by shaking bar to every alternate section of the grate, so that all clinkers are crushed and ashes sifted out of the fire, and by its lifting motion, due to shape of the sections, the fire does not become packed upon the grate, as is usual with many other grates. Each section weighs about fifty pounds besides the plate upon which it rests, and is from twelve to twenty-four inches long. It has been used for the last five years, giving excellent satisfaction, and is one of the features of the E. N. Gates system of

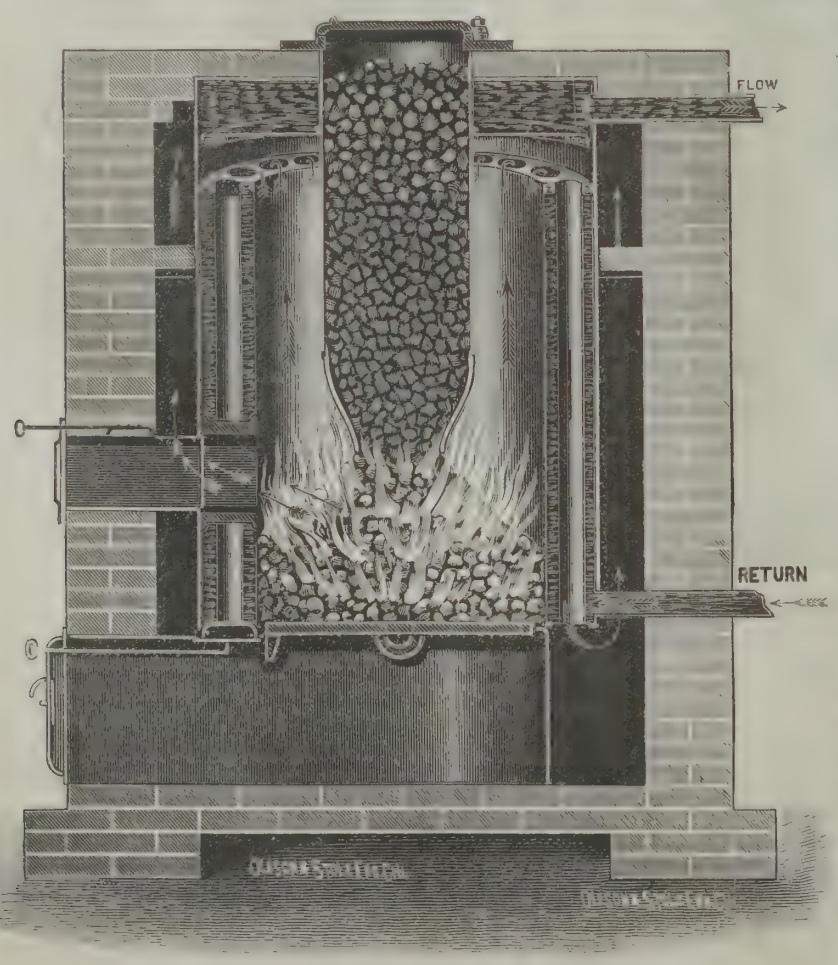


THE REED ROCKING GRATE.

Hot Water Heating, and is used by them in all of their heaters.

THE DUNNING HOT WATER BOILER.

The magazine stove has acquired within the last few years an unprecedented popularity in the United States. By its construction the need of attention and replenishing with fuel are reduced to a minimum. The introduction of this system of feeding used in steam heaters is well illustrated in the cuts accompanying this article. In the heater here shown will be recognized the combination of the self-feeding system with a return flue vertical boiler. In the center is the coal reservoir, open at the base and delivering thence an automatic feed of coal to the grate. Immediately around the coal reservoir or magazine is an annular space constituting the uptake flue for the products of combustion. This flue is surrounded by the annular water chamber, itself containing a number of vertical tubes, down which the smoke and hot gases descend. After their descent they issue at the bottom and rise once more outside of the boiler, filling the space between its sides and the brick setting and finally escaping through the chimney.



SECTIONAL VIEW OF DUNNING HOT WATER BOILER.

This course of the heating gases can be traced by the arrows on the cut. It will be seen that the gases first rise, then descend, and finally rise again, in each passage acting upon the entire height of the water column within the boiler. This threefold action insures a very thorough heating of the water and a great economy of fuel.

It will be seen that when the ash pit door is opened the up and down draughts in the front flue would be interfered with, and there would be a tendency to draw dust up through the outer flue. To avoid this a special damper is provided, which is manipulated by a handle passing through the door frame. This handle is seen in the large cut projecting from the door frame. Its construction is shown on a larger scale in the small cut. The outflow of water to the heating pipes is taken from the top of the boiler. The return enters at the bottom. The space intervening between these two connections insures a perfect and rapid circulation of the water. The apparatus is an example of approved practice in the construction of a magazine boiler.

It embodies the inventions of Mr. Wm. B. Dunning, and is manufactured by the New York Central Iron Works, of Geneva, New York.

The New York Safety Dumb Waiter.

Under the modern style of building, dumb waiters for dwellings, flats, and tenements are almost a necessity, and much time has been given this subject, both by inventors and manufacturers. Among the many styles on the market, none gives better satisfaction than the one known as New York Safety, and made by the Edward Storm Manufacturing Co., Limited, of Poughkeepsie, N. Y.

We are glad to learn that, since their first introduction, about a year ago, they have come into such wide use. Their simplicity, the ease with which they work, moderate price, adaptability to almost any size or kind of opening, and the fact that but one size is required for any sized well hole, have made them appreciated wherever used.

The manufacturers write us that they have in preparation and will soon bring out a hand elevator, for lifting heavy loads up to five hundred pounds.

Steam and Hot Water Heaters, Steam Supplies, etc.

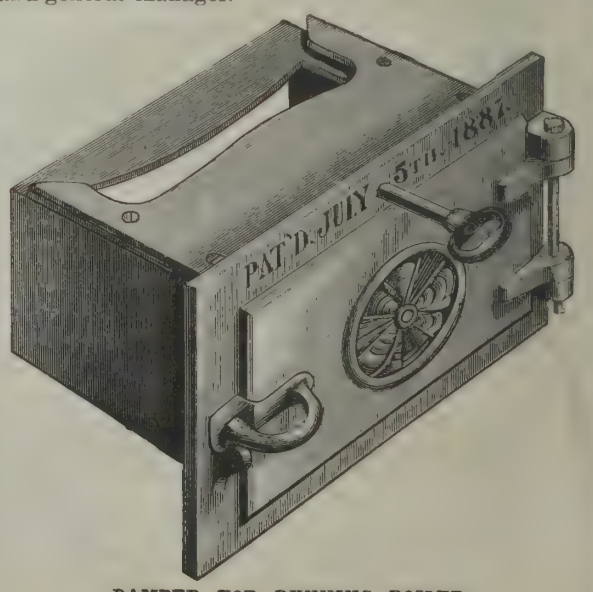
The Pierce, Butler & Pierce Mfg. Co., of Syracuse, N. Y., makers of the Florida steam heater, recently purchased the large foundry and machine shops at Geneva, N. Y., and have doubled their capacity, not having had sufficient facilities last year to fill their orders. They report orders now coming in from all over the United States and Canada, and have recently made some large shipments to England. The "Florida" is in high favor with the principal steam heating firms, being automatic, portable, and economical, and the firm are now amply equipped with facilities for turning out this steam heater in quantities sufficient to supply the demand.

Roofing Tin.

Messrs. N. & G. Taylor Co., importers of roofing tin, Philadelphia, say that the past season has been the largest they have ever experienced for the sale of their guaranteed brands of roofing tin. In their opinion, the time is approaching when architects will use special care in the wording of their specifications, and clearly name the brand of roofing tin they wish used. Another important thing is to see that the roofer to whom the contract is awarded uses the brand as specified. Messrs. N. & G. Taylor Co. furnish and guarantee the genuine old style brand of Extra Heavy Ternes. Every perfect sheet is stamped with the name of the brand and thickness, also the trade mark, thus protecting architects, roofers and property owners against the fraudulent use of inferior tin and dishonest competition.

Electric Light Cables and Insulated Wires.

The Standard Underground Cable Company, of Pittsburg, Pa., manufacturers of the Waring anti-induction and bunched cables, have recently issued a new price list, in which are given the feet per pound and weight per 1,000 feet of their weather proof line wire, with similar and further details regarding electric light cables. George Westinghouse, Jr., is president of the company, and C. H. Jackson vice-president and general manager.



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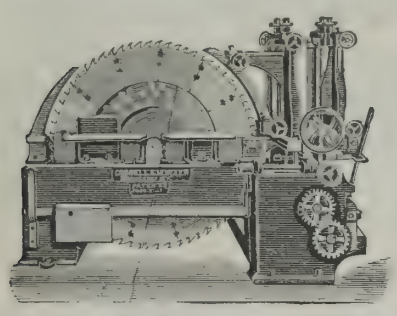

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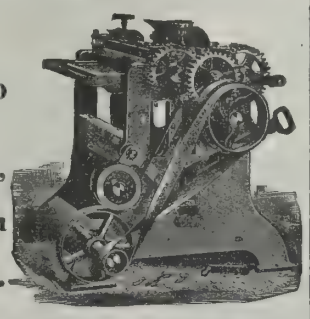

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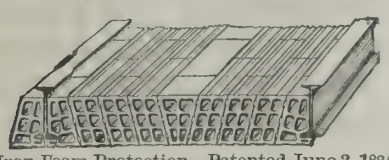

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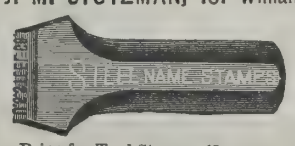

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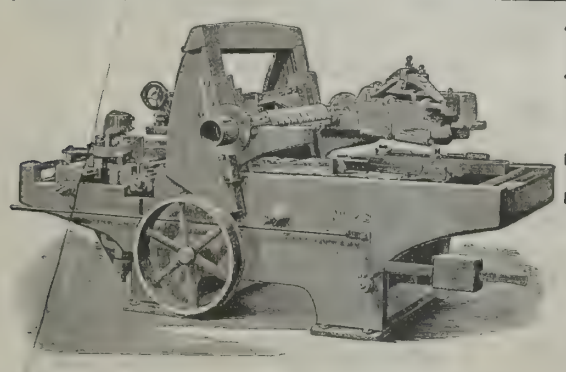

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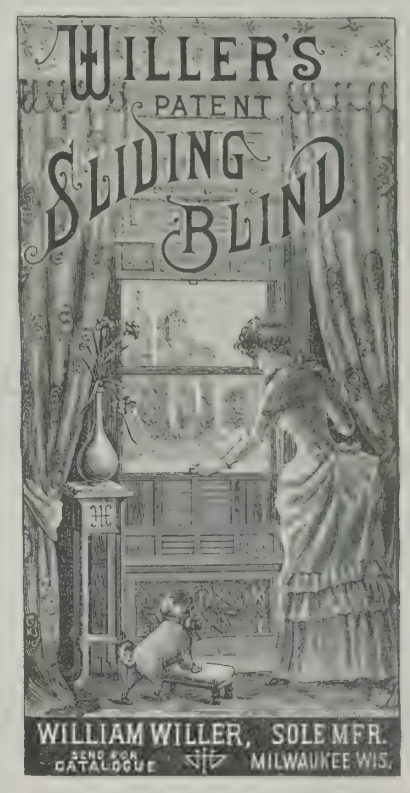

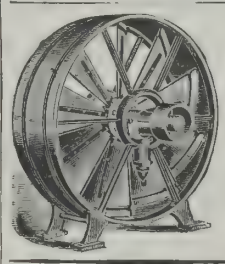

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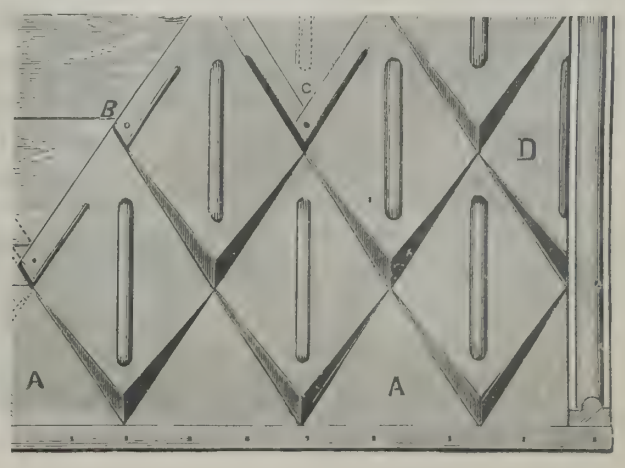

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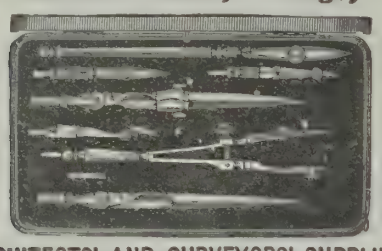

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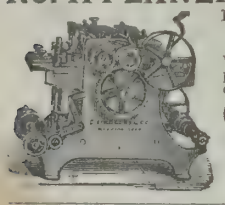

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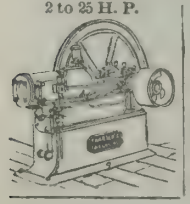

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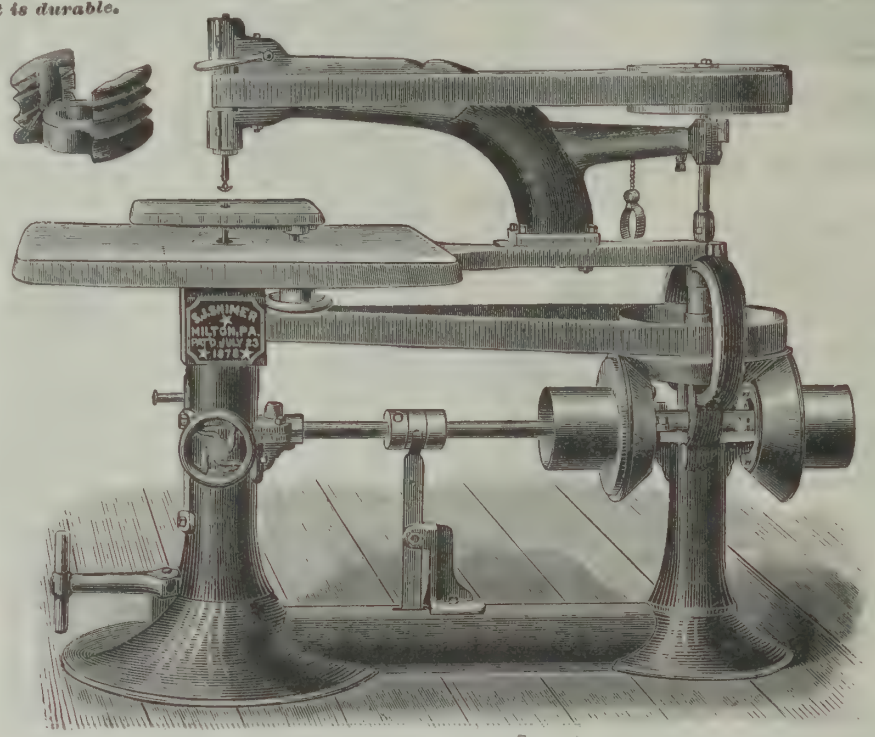
TO CHANGE from Surface Moulder to Variety Moulder, disconnect the rod that runs the incline on the T lever and pin it up. Run the housing up by means of the hand wheel until it stands above the belt line, remove the one spindle, substitute the other and set screw it to the housing. Turn the small table back under the arm. Raise the arm, disconnect the shaft that runs the upper pulley, and the Machine becomes an Edge Moulder without having any of its parts unbolted and laid away.

You never tire of the make up of this Machine, which is as simple and effective as it is durable.



Reversible Cutters for any shape of mould made to order, and warranted to cut free and easy. For Circulars and full information, address,

SAMUEL J. SHIMER & SONS,
MANUFACTURER of the SHIMER CUTTER HEADS and SPECIAL WOODWORKING MACHINERY,
MILTON, **PENN.**

THE MASON REDUCING VALVE
GIVES SATISFACTION WHEREVER USED
OFFICE 22 CENTRAL ST. BOSTON. MASS.

CARPENTERS' MACHINERY,
HAND AND FOOT POWER.

Lathes,
Tenoners,
Mortisers,
Scroll Saws,
Groovers,
Formers.

Rip Saws,
Cross Cut Saws,
Combined Saws,
Jig Saws,
Edge Moulders,
Dado Heads.

FRED. A. RICH, 25 South Canal Street, Chicago.

ALLEN B. RORKE,
Contractor and Builder,
423 WALNUT STREET,
PHILADELPHIA.

New York City. Room 217 Stewart Building.
C. POWELL KARR, C.E.
CONSULTING ARCHITECT.
Plans and Specifications prepared for Heating, Lighting, Ventilation and Sanitation of Buildings.
SPECIAL ATTENTION DEVOTED TO THE INSPECTION AND IMPROVEMENT OF THE ACOUSTIC PROPERTIES OF THEATERS, MUSIC HALLS, AND PUBLIC BUILDINGS.

PARQUET FLOORS
(BUTCHER'S PATENT).

The only Wood Flooring made on the correct principle, being laid with perforated metal tongues so that Floors of any thickness from ¼ inch up can be laid and blind-nailed.

Butcher's Boston Polish is the best finish for Hardwood Floors. For sale by agents in all large cities. Full information on application to

THE BUTCHER FLOORING CO.,
9 and 11 Haverhill Street, **BOSTON, MASS.**

ARCHITECTS
SHOULD ALWAYS SPECIFY

Mueller's WATER PRESSURE Regulators
to insure against the bursting of pipes and to preserve a uniform pressure throughout the building. Write for illustrated catalogue and prices.

H. MUELLER & SONS,
220 and 222 East Main St., Decatur, Ill.

PATENT RIGHTS FOR SALE.
APPARATUS FOR BUILDING
CONCRETE BUILDINGS AND WALLS.

County Rights, $50. State Rights, $500.
See descriptive notice in SCI. AMERICAN, May 22, 1886.
Send for circulars. Ransome, 402 Montgomery St., S.F.Cal.

TO ARCHITECTS.

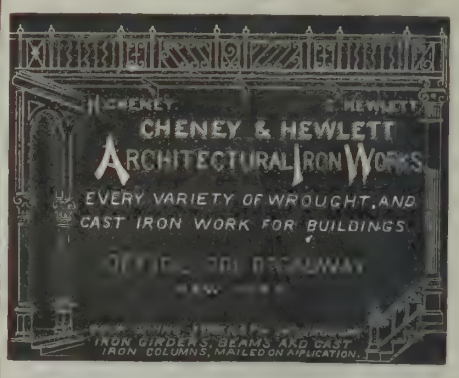
THE undersigned has had much experience in the making of perspectives from plans and elevations, and will promptly execute any orders, either in ink or colors as desired.

A. F. LEIGHT,
361 Broadway, New York.
☞ TERMS MODERATE.

ESTABLISHED 1843.

Manufacturers of

Stable Fittings and Fixtures,
IMPROVED and PATENTED.
IRON, BRASS, BRONZED and NICKEL-PLATED
POULTRY YARD APPLIANCES, ETC.
Low estimates furnished to Architects, Builders, Carpenters, Masons, etc.
Catalogue Mailed on Application.
SAMUEL L. BENT & SON,
No. 111 Chambers St., New York City.



ARCHITECTURAL AND ORNAMENTAL
IRON STAIRS, GRILLES, GUARDS, GATES, RAILING.
Special attention to Ornamental Work.
Vault, Area, and Skylight (Cement and Iron).
Designs, Estimates, and Catalogues on application.
MANLY & COOPER MFG. CO.
4150 Elm Ave., Philadelphia. 271 Broadway, N. Y.

Instantaneous Water Heater Co.

Manufacturers of the
DOUGLAS PATENT
Instantaneous Water Heater,
FOR
Baths and Domestic Purposes.

Can be used any place where gas and water can be obtained.

87 Dearborn St. Chicago.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. R. E. writes: I have a fine Arkansas oil stone which refuses to work properly after several years of constant use. My tools slide over it without being sharpened. How can I make it cut? A. Soak the stone in turpentine or naphtha for a few days, when it will cut as new.

(2) T. M. S. asks: 1. What can I put on my watch face to make it luminous, so that the time can be read in the dark? A. Coat it with luminous paint. See the articles on the paint in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249 and 497. 2. What solution will remove ink stains from carpets and blots from paper? A. Use a solution of oxalic or citric acid, followed, in the case of the carpet, with copious washings with cold water. 3. How can I make a good, hard walk at small cost, in the country? A. See the article on "Foot Walk Pavements," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 82.

(3) S. J. S. asks (1) a receipt for a dead black paint for photo. use and inside of optical instruments. A. For a dead black for inside of tubes use lampblack or artists' boneblack mixed with alcohol in which a few drops of shellac varnish have been mixed. No more shellac than will just make the black stick. Make a trial on a piece of metal. If, on drying, it shows the least shining surface, there is too much shellac. If, on the contrary, the black readily rubs off with the fingers, there is not enough shellac. A drop of shellac varnish to a tablespoonful of the mixture may change its drying character to a shining or a dead surface. As but a very small quantity of the blacking is needed for an instrument, we cannot readily give the precise quantity. 2. Can a wooden tray be coated with rubber so as to resist acids (chemicals used in photography)? If so, how? A. A wooden tray can be coated with rubber varnish and dried in an oven. We recommend paraffine as more suitable for chemicals. Warm the tray and send the paraffine well into the wood with a warm iron.

(4) A. B. C. says: I have a cellar with clay bottom. Kindly give me receipt for a cement that I can lay on the clay to make a good hard floor. A. Cover with a thick mortar made of Portland cement one part, clean sharp sand three parts.

Klein's Economist Steel Plate Furnaces

AND

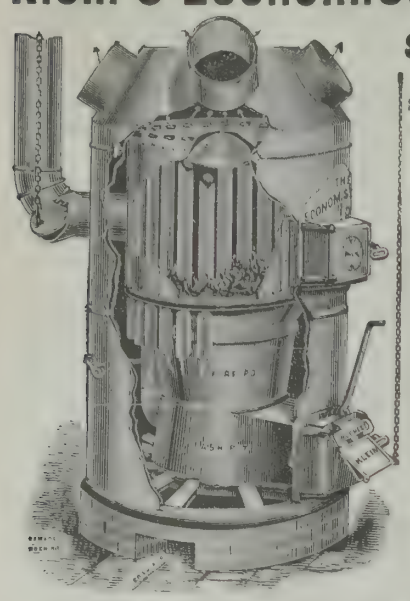
STEEL PLATE ECONOMIST RANGES

Are Superior to all others.

Simplicity, Durability, Economy, are its chief advantages.

TRY THEM, AND YOU WILL HAVE NO OTHERS.

KLEIN FURNACE CO., Rochester, N. Y.



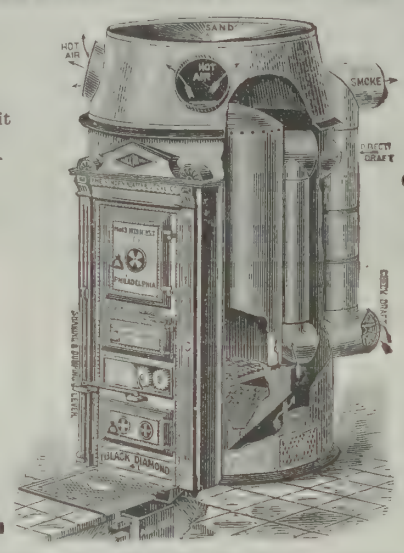
Black Diamond Steel Dome Furnaces.

ALL SIZES.

Patent Self-Cleaning Ash Pit Obviates labor, dirt, and annoyance. Sure preventive from fire caused by hot ashes.

Patented and Manufactured by

The Schoen Heater and Stove Co.



PORTABLE and BRICK SET.

Common Sense Clinker-Crushing Grate. Great saving of labor and fuel. Perfect Dump.

Office and Salesroom

13 North Eleventh St.

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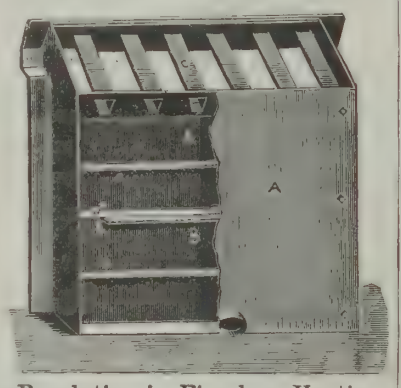
AGENTS WANTED IN EVERY TOWN.

The OMEGA FIREPLACE FURNACE

20 page illustrated catalogue, containing full information and prices, sent to any address.



A Double Heater and Perfect Ventilator. Gives the combined heat of both a Furnace and Fireplace, with Perfect Ventilation. Equalizes the heat in every part of the room. Burns equally well Hard or Soft Coal, Wood or Coke. Address

A Revolution in Fireplace Heating.

OMEGA STOVE AND GRATE CO.,

89 Euclid Ave., Cleveland, Ohio.

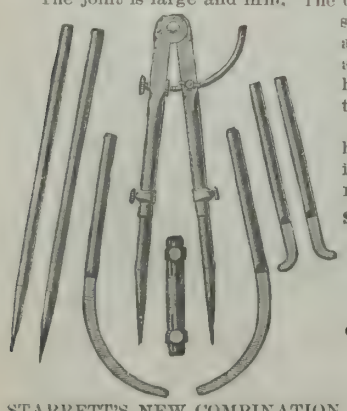
New Combination Dividers.

Forming Dividers with short and long extension points (pencil may be used in connection with either), Outside Calipers, Inside Calipers and Hermaphrodite Calipers.

The head and socket legs of this tool are made from drawn (not cast) bronze metal, and are hard, tough, strong, and finely finished.

The joint is large and firm. The quadrant is round and fastened by an improved method. The steel points are tempered by a process which leaves them hard and tough. On the threaded end of the quadrant, between the adjustable legs, is a knurled nut, against the inside of which a helical spring acts. After the points are adjusted the nut may be turned back against the leg, LOCKING IT FIRMLY.

A common pencil fits either socketed leg, while an auxiliary holder is also furnished to fit reversed end of either point. This is one of the most useful combinations of the kind, as well as the BEST MADE tool ever produced.



STARRETT'S NEW COMBINATION DIVIDERS.

Send Stamp for Illustrated Price List of Fine Tools for Mechanics.

L. S. STARRETT,

MANUFACTURER OF

Combination Squares, Caliper Squares, Bevel Protractors, Thread Gauges, Steel Rules, Surface Gauges, Scratch Gauges, &c., &c.

Full Line of Calipers and Dividers, best on the market.

ATHOL, MASS.

The M. H. JACOBS' FURNACE CO.,

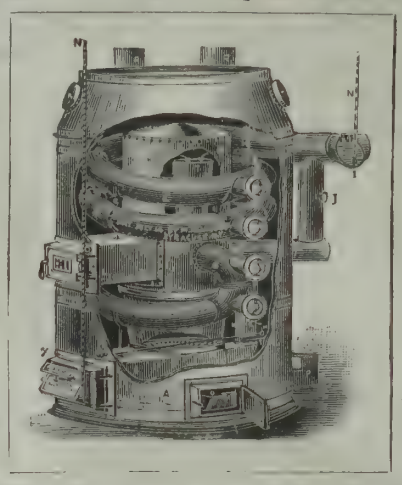
Manufacturers of the celebrated wrought iron **spiral** radiator and steel dome portable

WARM AIR FURNACES

With Hot Water Attachment.

Most Perfect and Durable

THE KING of HEATERS



It wears the Crown of Superiority.

Most Economical AND POWERFUL.

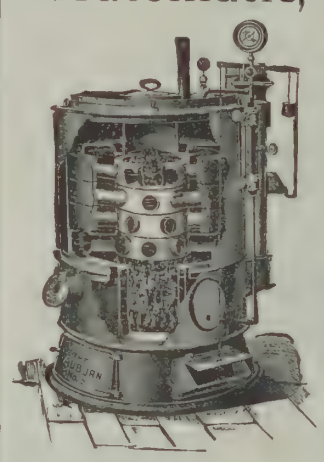
The Spiral Radiator is exciting universal attention and careful examination by the public, as evidenced by the drift of popular favor. A cursory examination alone is sufficient to show its merits and superiority. It combines all the requisites of a successful furnace, viz.: Future Maintenance, Efficiency, and Power to Economize and Radiate the Heat Desired. No less attention has been given to the qualities upon which depend the health and vitality of our families.

MANUFACTURED BY

M. H. JACOBS' FURNACE CO., Syracuse, N. Y.

"THE AUBURN" STEAM HEATING BOILERS,

Automatic, Self-Feeding, Portable.



Requires attention but once in from twelve to twenty-four hours. Fuel magazine surrounded by water. Self-locking shaking grate. Waste of coal *impossible. No dust. No gas.*

The Woodcock Patent Shaking Grate, For Boiler Furnaces of all Descriptions

Saves its cost in a year, supplanting all other shaking grates. No waste of coal. No burnt or broken grates. Self-locking, and as nearly automatic as a grate can be made.

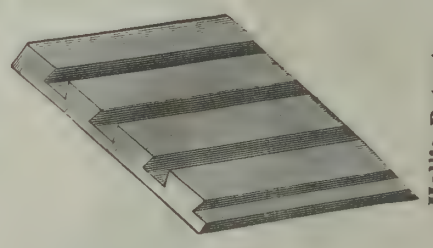
Send for Illustrated Catalogue.

Woodcock & Co., Auburn, N. Y.

HOW TO BUILD A PERFECT HOME WITH VERY LITTLE COST.

Byrkit's Patent.

USE COMBINED SHEATHING LATH.



Hall's Patent.

It makes a cheaper, warmer and stronger house than brick or stone. It is a dry and therefore a healthy house. The plaster will not crack. Architects and Builders specify it all over the country.

ADDRESS

The Byrkit-Hall Sheathing Lath Co.,

226-228 LA SALLE STREET, Room 28, CHICAGO, ILL.

For Eastern and New England States, address

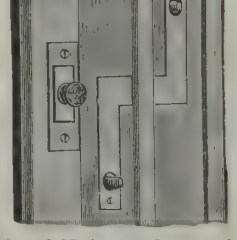
I. C. JENKINS, OSWEGO, N. Y.

Timby's Burglar-Proof Sash Lock and Ventilator.

Patented March 29, 1887.

Manufactured from the Best Malleable Iron, Steel, Brass and Bronze Metal.

Fig. 1.—Section of Frame with Lock Applied.



Thumb Nut moved upward, releasing upper sash.

Is very simple in construction, strong and durable, absolutely **Burglar-Proof**, and a perfect Ventilator; automatic in action, easily applied to any window, as it adjusts itself to varying thicknesses of sash or inside stops.

Only One Lock is Required for a Window,

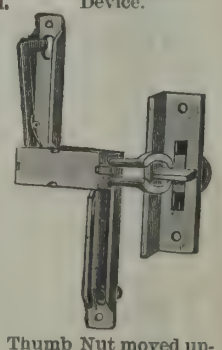
as it controls both sash perfectly, bolting either or both securely in any position desired, thereby affording means for perfect ventilation, and at the same time absolute security against burglars and sneak thieves. It is easily operated, ornamental in appearance, and does not interfere with applying weather strips or inside blinds. It is just as important that each and every window should be provided with a good, substantial lock as that the front door should be. *Buy the Timby Burglar-Proof, and take no other.* The convenience and absolute security afforded will be ample reward. Full directions and pattern for setting accompany each lock.

For Price-List and further information, apply to

JENKINS & TIMBY,

OSWEGO, N. Y.

Fig. 2.—Back View of Lock and Operating Device.



Thumb Nut moved upward and bolt thrown back, same as in Fig. 1.

Classified Index of Advertisements Published in the Present Number of the Scientific American, Architects and Builders Edition.

CLASSIFIED ADVERTISEMENTS.—Continued from page xi.

The BEST Roofing Tin is the CHEAPEST!

But how are you to know that you get the quality and brand wanted?

Because every PERFECT SHEET of the following three extra fine guaranteed brands of Roofing TIN IS STAMPED at the works with the name of the brand and the thickness. Please note this.

"Old Style." Extra Heavily Coated. The Best Made.

"Westminster." Re-dipped. Made from Heavy Iron.

COOKLEY K Highest Grade of Heavy Regular Coated.

EVERY BOX IS GUARANTEED.

Sample pieces of the Tin, also circulars and full information given.

N. & G. TAYLOR CO.

Established 1810. 77th year.

PHILADELPHIA.

Prepared Roofing

BEST, CHEAPEST, MOST DURABLE.

ANYBODY CAN PUT IT ON. EASILY HANDLED.

PUT UP IN ROLLS OF 100 SQUARE FEET.

Send for Latest Circular, Price List, etc.

MANUFACTURED BY

M. EHRET, Jr., & CO.,

PHILADELPHIA, 423 Walnut Street. **ST. LOUIS,** 113 North 8th Street. **CHICAGO,** 50 Dearborn Street.

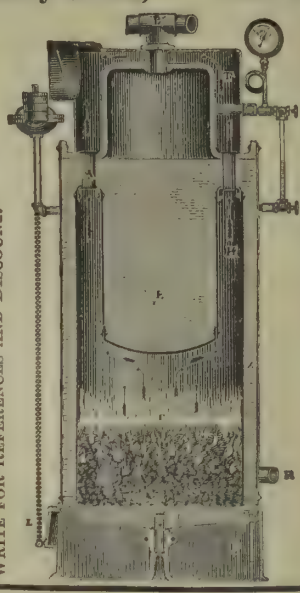
Duplex Steam-Heater Co.

Manufacturers under FISKE'S PATENTS,

10 Barclay Street, New York.

Simplest in Construction. Largest Steaming Capacity.

WRITE FOR REFERENCES AND DISCOUNT.



AGENTS WANTED EVERYWHERE.

Send for Illustrated Catalogue and Price-List.

YOUR ATTENTION

IS ESPECIALLY DIRECTED TO THE

Advertisement (on Page 1 of Advertising)

— OF THE —

Celebrated Economy Heaters,

J. F. PEASE FURNACE CO.,

Syracuse, N. Y., U. S. A., and Toronto, Ont., Canada.

WOOD MANTELS.

INTERIOR DECORATIONS,

ARTISTIC FURNITURE,

DESIGNED AND MANUFACTURED BY

GEO. W. SMITH & CO.,

3907 to 3919 Powelton Avenue, Philadelphia, Pa.

FAYETTE R. PLUMB,

Successor to YERKES & PLUMB, Manufacturer of

Hammers, Edge Tools, Sledges, Blacksmith and Railroad Tools.

MAIN OFFICE and WORKS:

PENN. R.R., TUCKER AND JAMES STREETS, PHILADELPHIA, PA.

Architects, Roofers, Builders. "Alderly" and "Penn" Old Method Roofing Plates

THE TWO BEST BRANDS OF GUARANTEED ROOFING PLATES. THERE ARE NO OTHER BRANDS EQUAL TO THESE PLATES.

ALDERLY { Made of Siemens-Martin Soft Steel, same as Old Style Plates. Next in Quality, of Standard Weight, Perfectly Square, Perfectly Assorted. True to Gauge. We carry in Stock, Stamped and Unstamped.

"PENN" OLD METHOD Treble Coated Roofing Plate. { **GUARANTEED** to stand any test demanded. Guaranteed to be heavier coated than any other plate, each box, 14x20 contains **20 lbs.,** and 28x20 contains **40 lbs.** Guaranteed to have all the Coating that it is possible for any plate to hold. Guaranteed Rolled true to Gauge. Absolutely perfect in every respect. Guaranteed to last longer on Roof without being painted than any other Old Style Plate. Guaranteed sheets perfectly square and flat. Both **IC** and **IX,** all strapped with iron.

SOLE MANUFACTURERS of the "PATTEN" METALLIC ROOFING SHINGLES.

GUMMEY, SPERING & CO., **Philadelphia—Liverpool.**

STAINED GLASS

For Churches and Private Dwellings, etc.

JEWELED MOSAICS.

Illustrated Catalogues Free.

ALFRED GODWIN,

1201 Market Street, Philadelphia, Pa.

WOOD WORKING MACHINERY.

Band Saws, Jointers, Pony Planers, Shapers.

SPECIAL FOR CARPENTERS AND BUILDERS.

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WINDOW GLASS.

Malaga Glass & Mfg. Co.,

—MANUFACTURERS OF—

High Grade American Window Glass

AND IMPORTERS.

FACTORIES, **MALAGA AND MILLVILLE, N. J.**

OFFICE, **400 CHESTNUT ST., PHILADELPHIA.**

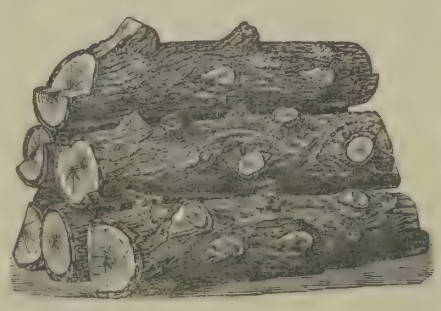
"GIANT" PORTLAND CEMENT,
"EGYPT" PORTLAND CEMENT,
"IMPROVED UNION" CEMENT,
"UNION" CEMENT.

LESLEY & TRINKLE, Sales Agents, 216 South Third St., Phila.

GAS FIRES

Resembling Wood or Coal.

Burning Natural or Manufactured Gas.



HENRY P. DIXON & CO.,

Manufacturers,

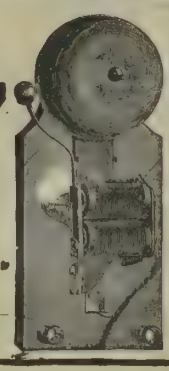
1330 Chestnut St., - Phila., Pa.

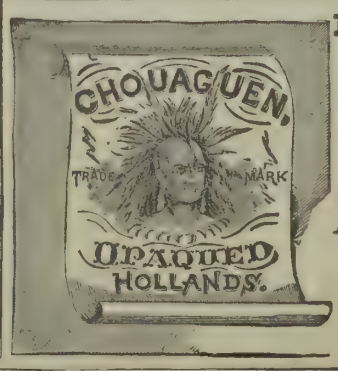
SHAW & GEARY,

MANUFACTURERS & DEALERS

ELECTRICAL APPLIANCES.

53 No. Seventh St., PHILADELPHIA.





In ordering your Window Shadings specify

"CHOUAGUEN,"

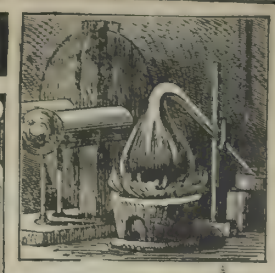
AND TAKE NO OTHER.

See Trade Mark.

Are the Best Finished, Most Uniform, and Most Durable Goods made.

ENQUIRE OF ANY DEALER.

No. 31. | With Two Supplements consisting of Two Plates in Colors and One Large Sheet of Details. MAY, 1888. Single Copies, 25 Cents.—$2.50 a Year.



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ARCHITECTS AND BUILDERS EDITION.

New York: Published by MUNN & CO., 361 Broadway, corner Franklin Street.

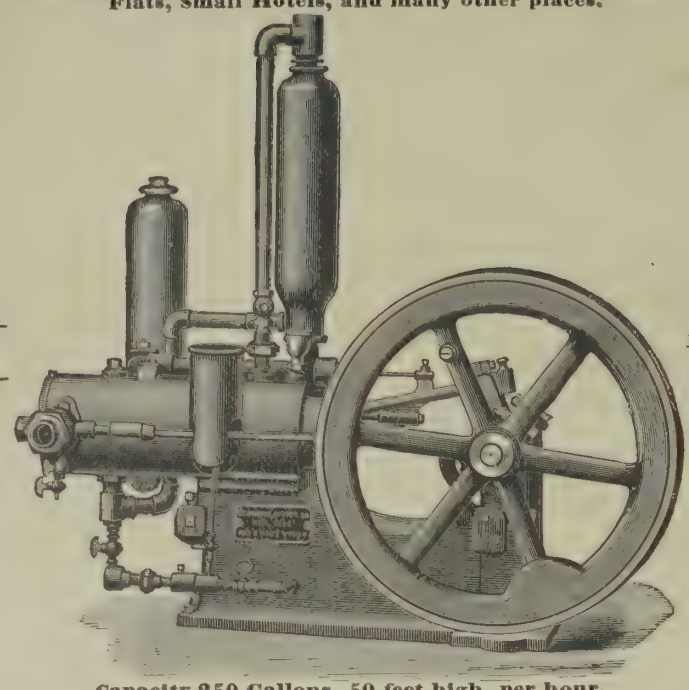
☞ See Classified Index of Advertisements, in present Number on pages xi and xii.

ECONOMIC ✣ GAS ✣ ENGINES.

Best in principle, workmanship, and materials. An unequaled small Motor adapted to all uses. When the Motor is not at work, the expense of running it ceases. Simple, Safe, Economical, Durable. No extra Insurance required.

PLUMBERS' GAS ENGINE.

Especially adapted for pumping water in Private and Apartment Houses, Flats, Small Hotels, and many other places.



No. 6. — 1 Man.

Capacity 250 Gallons, 50 feet high, per hour.

LARGER SIZES.

No. 7. One-Half Horse, 600 Gallons, 50 feet High, per Hour.
No. 8. One Horse, - 1,500 " " " "

GASOLINE GAS ENGINES.

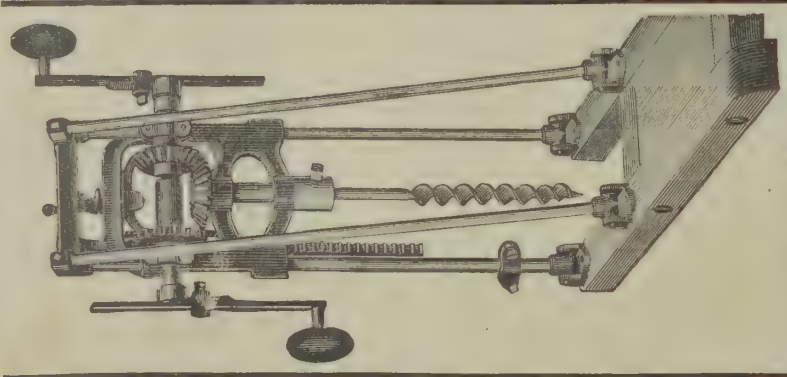
No. 15. One Man, - 300 Gallons, 50 feet High, per Hour.
No. 16. One-Half Horse, 600 " " " "
No. 18. One Horse, - 1,500 " " " "

Four Sizes, from Motor for Sewing Machine or Dental Engine to One Horse Power.

Our Gas Engines will work satisfactorily when attached to Gasoline Machines.

SEND FOR ILLUSTRATED CATALOGUE.

Economic Gas Engine Co.,
Office and Salesroom, 34 DEY ST., NEW YORK.



Steel Boring Machine

SEND STAMP FOR CATALOGUE.
MILLERS FALLS CO.,
93 Reade St., New York.

THE JACKSON
Ventilating Grate & Fireplace Furnace

A FURNACE
IN THE
FIREPLACE,

So combined with the grate as to increase the heat of the latter fourfold, and effect perfect ventilation by producing an inflow of warmed outdoor air and exhaustion of the air near the floor.

OVER TWO HUNDRED
different styles of design and finish

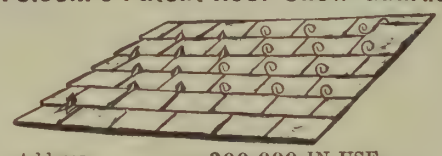
In use ten years, with all kinds of fuel; heating rooms adjoining, or on different floors. Reports from every State and Territory, and

ILLUSTRATED CATALOGUES
Sent on Application.

EDWIN A. JACKSON & BRO., 50 Beekman St., New York.

ARCHITECTS, BUILDERS!
ATTENTION IS CALLED TO
ADVERTISEMENT ON PAGE iii
FRANK B. MALLORY.

SPECIFICATIONS SHOULD INCLUDE
Folsom's Patent Roof Snow-Guards



Address, —300,000 IN USE.—
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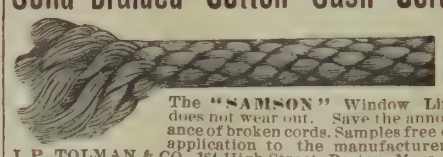
Solid Braided Cotton Sash Cord.



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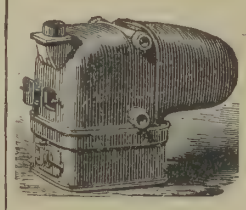

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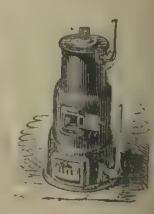

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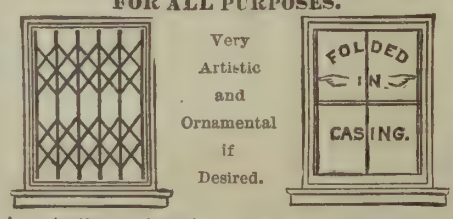

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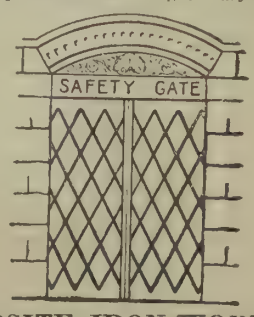

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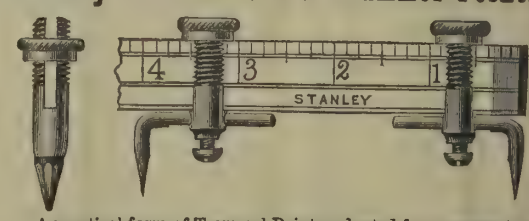

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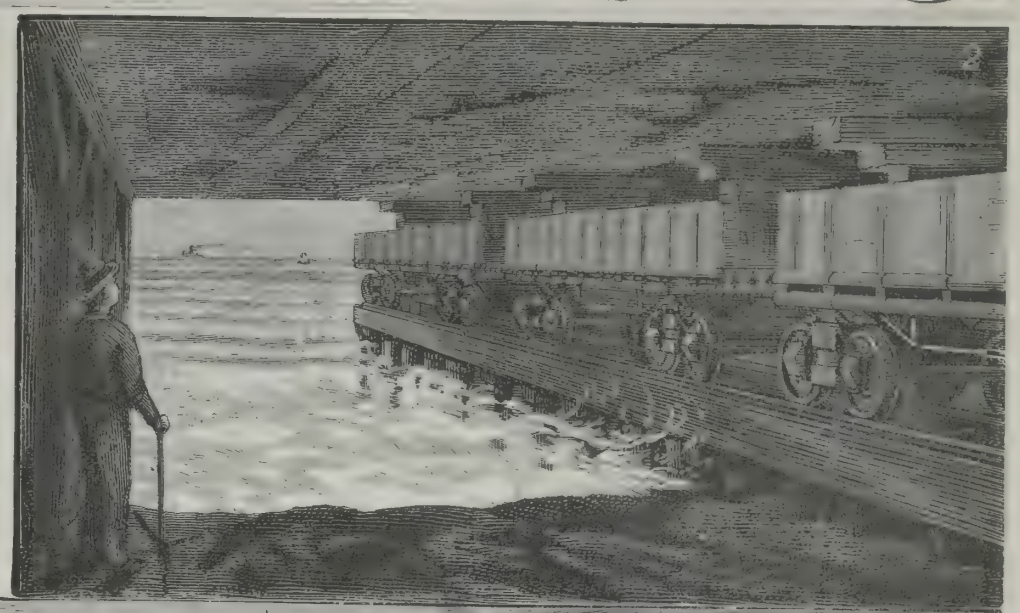

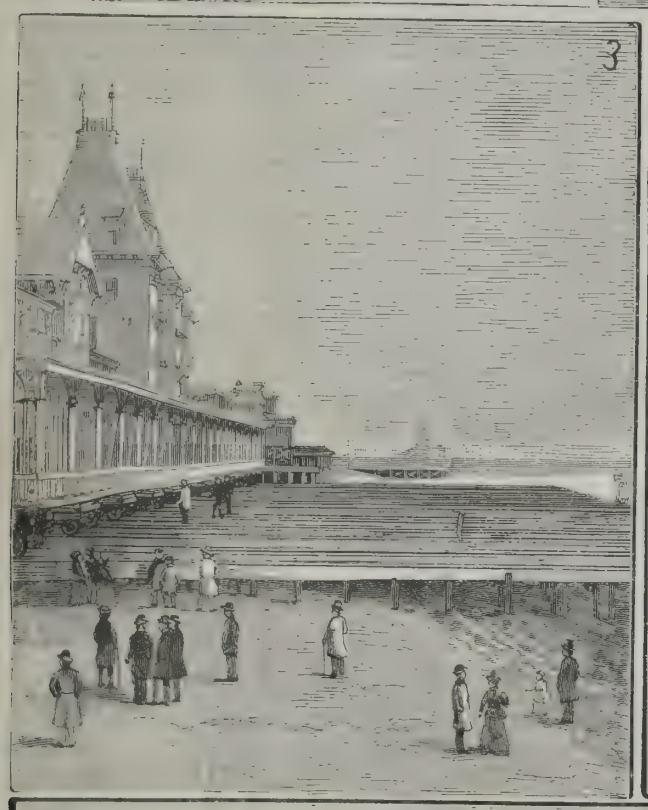

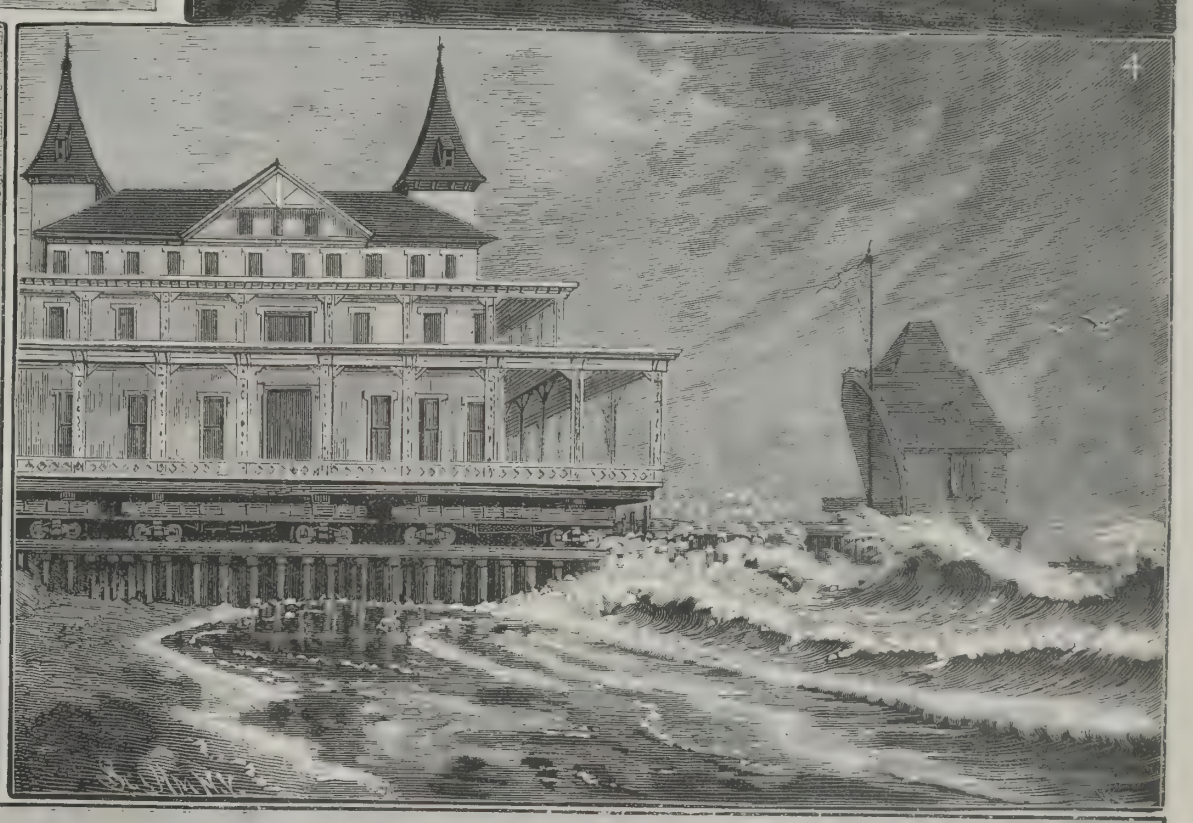

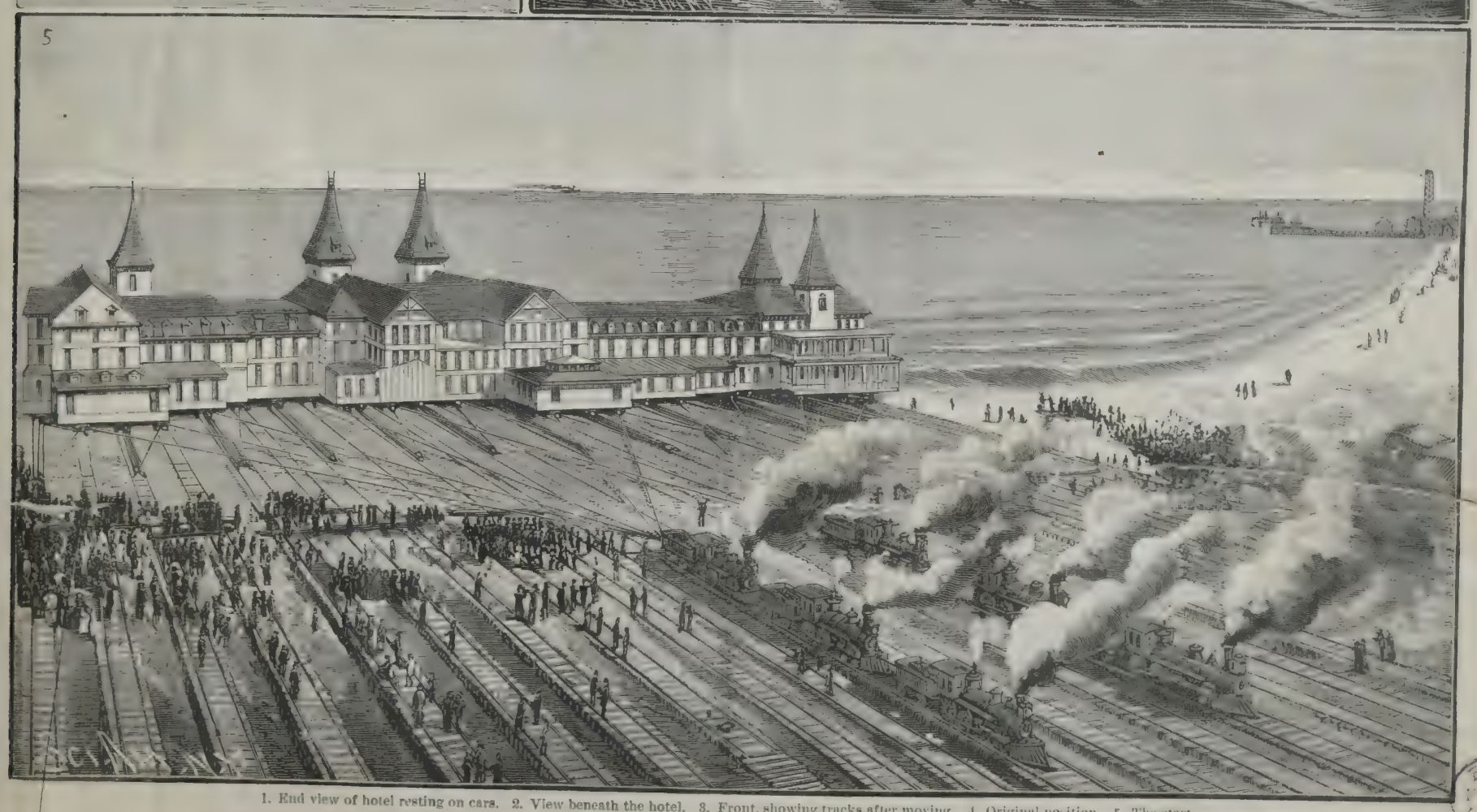

1. End view of hotel resting on cars. 2. View beneath the hotel. 3. Front, showing tracks after moving. 4. Original position. 5. The start.

MOVING THE BRIGHTON BEACH HOTEL—GENERAL VIEW OF THE OPERATIONS.—[See page 90.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, MAY, 1888.

THE Scientific American, ARCHITECTS AND BUILDERS EDITION.

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CONTENTS

Of the May number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *)

A DOUBLE HOUSE FOR $2,500.

One of our colored plates for this month shows a comfortable double house, conveniently arranged and economical in cost. We also give the floor plans and various details, on our extra thin sheet, all of which will make the construction very plain.

This house has a front of 30 feet, side 42′ 6″, including porch. The heights are: cellar, 6′ 8″; first story, 8′ 6″; second story, 8′. The foundation is of brick. First and second story clapboards and shingle, roofs shingle.

The cellar extends under the entire house. Three sliding doors between parlors and dining rooms. Large pantries and closets. The cost is $2,500, including hardwood mantels in parlors and dining rooms. Picture moulding. Hard finished walls throughout. Gas piping and cistern.

A COTTAGE OF MODERATE COST.

One of our colored plates this month illustrates a pleasant dwelling, erected near New York. We also give the floor plans and details on our extra thin sheet, which will render everything about the construction perfectly plain and easily understood. There are open fireplaces in the parlor, dining room, and two chambers above. Good, large, spacious hall and wide staircase. Large closets and pantries. The house is arranged to be heated by hot air furnace. A back stairway is provided by the steps which start from the kitchen and connect with the landing of the main staircase. Two rooms finished in the attic, a large open garret for storage, cellar under the whole house. The front is 30′; side, 36′, not including the piazzas. Height of cellar, 7′. First story, 9′ 8″; second story, 9′ 2″. Foundation stone, first story clapboarded, second story and gables shingled, roof stamped tin shingles. Cost, not including the furnace, $5,000.

Relative Strength of Stones and Bricks.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Howard Murphy presented a diagram showing the results of Watertown Arsenal tests of the crushing strength of Potomac red sandstone and other building stones, bricks and brick masonry. The diagram shows the following:

No. of Tests.	Material.	Crushing strength in lb. per sq. in. FROM	TO
6	Lee, Mass., marble	20,504	22,900
10	Potomac red sandstone	16,625	22,102
2	Coshohocken, Pa., limestone	14,090	16,340
2	Hummelstown, Pa., sandstone	12,810	13,610
6	Montgomery Co., Pa., blue marble	9,590	13,700
3	Philadelphia pressed bricks	7,210	9,050
4	Indiana limestone	7,190	10,620
11	Philadelphia hard bricks	5,540	20,830
10	Ohio sandstone	3,940	16,280
6	Philadelphia brick masonry in cement mortar.	1,600	2,685
6	Philadelphia brick masonry in lime mortar	799	1,914

He also noted the other qualities of the Potomac red sandstone which are of special value to the engineer in construction—its durability under the action of frost, fire, and wear, and its resistance to dampness.

Mr. Edward Hurst Brown mentioned that the reason the Potomac red sandstone was not more used for architectural purposes was that, while of a beautiful color, owing to its extreme hardness, it was very difficult to dress, and also that very often in an apparently perfect stone a flaw would develop in dressing the face which would render it useless for facing stone. He also mentioned having seen at Brentsville, Prince William Co., Virginia, an old church built of practically the same stone, taken from the neighboring Bristow quarry, which had stood for over one hundred years, exposed to war and the elements, and which showed no signs of defects due to frost or action of the weather.

Echoes and Reverberations in Rooms.

The effect of echoes in a small room is generally unnoticed; the echo returns so quickly that the ear receives it as coincident with the original sound, to which it in that case merely adds strength, perhaps prolonging it very slightly. If the room be larger, and the echoing wall so distant that the interval is sensible, the echo makes confusion. If on a calm day we advance toward a wall, producing at each step some sound, we will find a point at which the echo ceases to be distinguishable from the original sound. The distance from the wall, or the corresponding interval of time, has been called by Professor Henry the limit of perceptibility. This limit will vary with the nature of the sound; if the sound be sharp and distinct, as that produced by striking some hard substance, we shall find the limit of perceptibility less than for the more prolonged sound produced by the voice. The limit will probably vary also with the acuteness of the ear, some persons being probably able to separate sounds undistinguishable to others. The general limit is probably about 30 ft. or 35 ft. It should be ascertained exactly, and in constructing a room for public speaking the height of the ceiling should not exceed this limit. The sound will then be strengthened to the speaker himself by the echo. The interval between the original and reflected sounds will be shorter for all his hearers than for himself, as twice the path of the voice and echo for the speaker is considerably longer than the difference between the paths of the direct and reflected sounds of one of the auditors. The direct echo from the ceiling then becomes an advantage, by strengthening without confusing the sound. But echo acts in still another way by being repeated between opposite surfaces. The effect is like the multiplication of the image of a candle between two opposite and parallel mirrors. This might trouble us between the ceiling and the floor of our room; but a thick carpet absorbing sound and not reflecting it will remove this difficulty. Reid proposed in the houses of Parliament to make the ceiling high in the center, declining toward the sides, with floors and galleries rising from the center toward the walls, thus reducing the height and surface of the walls, so as to diminish the quantity of sound reflected from them as much as possible. All regard for architectural beauty forbids the adoption of this construction, which seems to have been modeled upon an empty tortoise shell. Breaking the walls into deep panels has also been proposed. But when we recur to the limit of perceptibility we shall perceive that a panel or recess must be over 30 ft. deep to separate the echoes from the bottom of the recess and from the face of the wall. The surfaces of mountains covered with trees and rocks return echoes. No wall of an inhabited apartment can be made rougher than these natural reflectors. A simpler and more effectual method of controlling the echoes from the walls will be to cover them with drapery absorbent of sound. The echoes from the ceiling are thus turned to account, and those from the floor and walls guarded against; but the echoes from small objects and surfaces may still be troublesome unless provided for. The trunks of trees in the edge of a forest return together a distinct echo. The beams under the flooring of the Menai suspension bridge are instanced by Herschel as giving a curious echo. To guard against this, it will be sufficient to cushion the chairs and cover the desks with some material which will not reflect sound.—*M. C. Meigs.*

Egyptian Papyri.

The *Progresso* states that Professor Karabacek, in a lecture delivered on the 25th of January, at the Vienna Museum, on the papyri found near the city of Arsinoe, in Central Egypt, announced that this valuable collection of documents contains about 100,000 papyri and 20,000 plates or charts, comprising a period of 1700 years, from 1400 B. C. to 1400 A. D.

These papyri are written in sixteen different languages, and treat of very diverse questions.

Through both a microscopic and historical examination, made in great part by Professors Wiesner and Karabacek, it was found that the manufacture of paper from rags was invented neither by the Germans nor the Italians, since the Arabs, in the year 751 of our era, began the manufacture of paper from linen rags in a manner analogous to the modern method. The same professors likewise found from 27 of the charts that the invention of printing could not be attributed to Gutenberg, since 500 years before him these charts were printed in Egypt, through wooden models or types, for writing as well as for ornaments.

Dimensions of the Most Important of the Great Cathedrals.

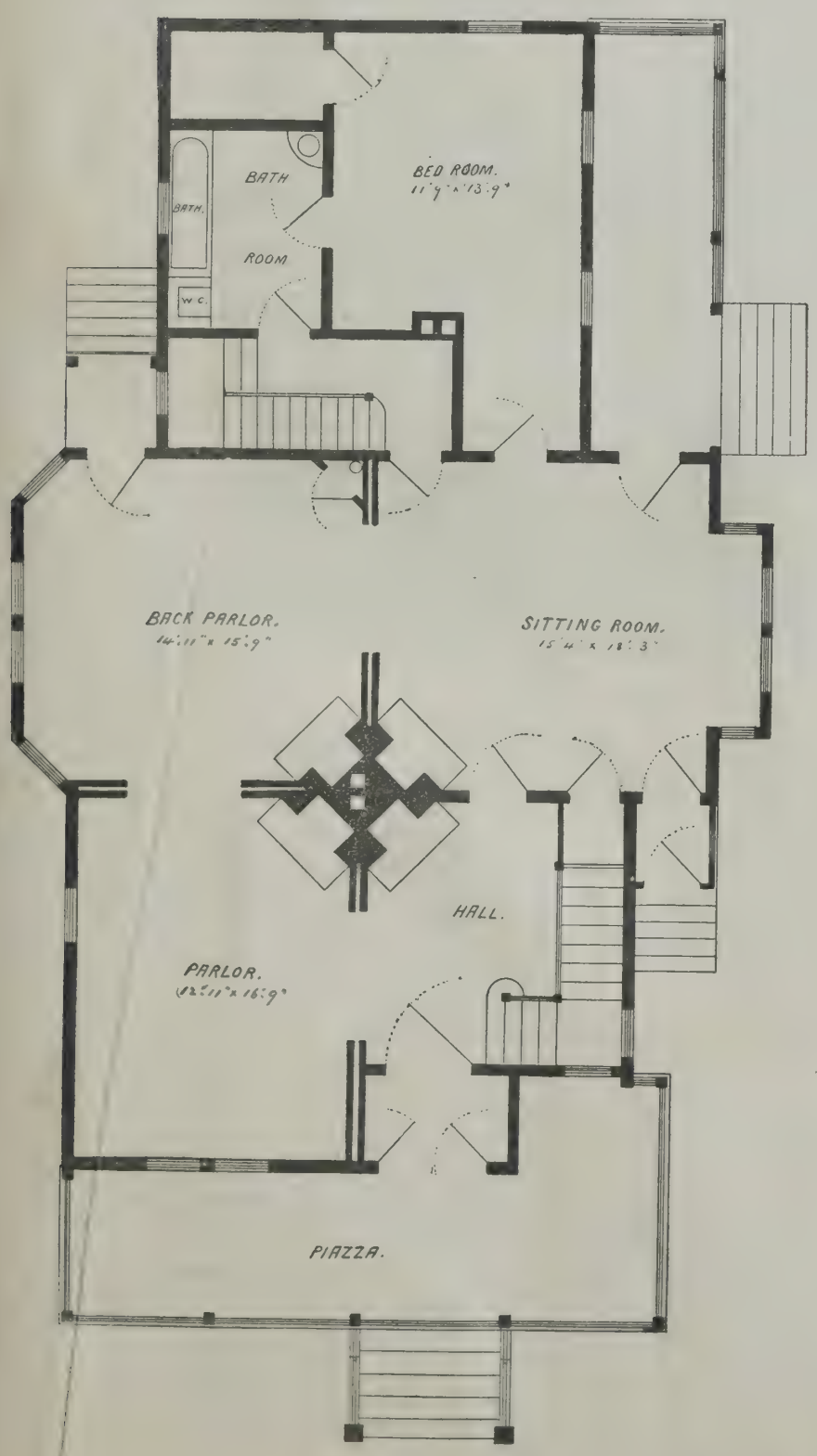
	Length, feet.	Breadth, feet.	Height, feet.
St. Peter's	613	450	438
St. Paul's	500	248	404
Duomo	550	240	375
Notre Dame	416	153	298
Cologne	444	282	...
Toledo	395	178	...
Rheims	480	163	117
Rouen	469	146	465
Chartres	430	150	373
Antwerp	384	171	402
Strasbourg	525	195	465
Milan	477	186	360
Canterbury	530	154	235
York	524	261	...
Winchester	554	208	...
Durham	411	170	214
Ely	517	178	...
Salisbury	473	229	379

Soft Bricks.

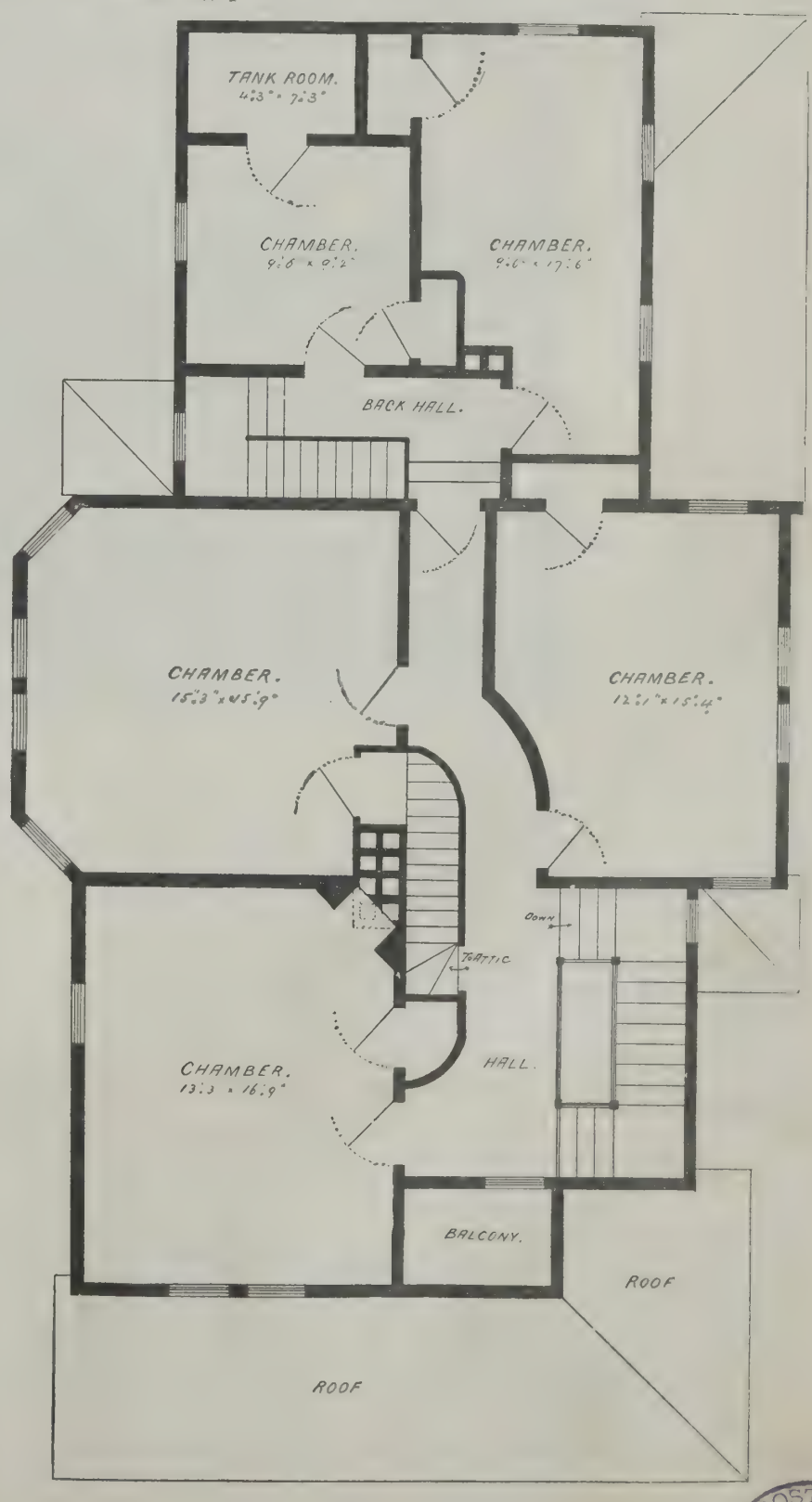
Mr. G. R. Burnell, writing to the [illegible] that the influence of the atmosphere upon [illegible] depends both upon the composition of the clay and on the degree of burning. Portions of carbonate of lime are converted into quick lime, and, when wetted, expand and disintegrate the mass. Both brick and stone are acted upon most rapidly where there are frequent changes from dampness to dryness. The foundations of buildings do not suffer as much as parts of the wall from one to three feet above the surface.

How to make Artificial Lignum Vitæ.

The wood is first saturated with oil, and then subjected to the action of a powerful press, which compresses the fibers and greatly increases the density of the wood.



FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

A SIX THOUSAND DOLLAR HOUSE.—[For description see page 92.]

MOVING THE BRIGHTON BEACH HOTEL.

We illustrate in our present issue the moving of the Brighton Beach Hotel, one of the great buildings of Coney Island, near this city. For many months there has been a marked tendency on the part of the water to wear away the sandy beach upon which the building was erected. During the past winter this tendency increased, and assumed alarming proportions. It is possible that the erection of protecting bulkheads on the neighboring property had the effect of creating a scouring action on the part of the waves and currents. Whatever the cause, during the past fall and winter months the sea advanced. The music stand, once safely on the beach between the ocean and the hotel, was surrounded by water, and remained supported by piling a few feet above the tide. The water still encroached, and soon made its way under the hotel, and it was evident that unless some preventive measures were taken, the house would be undermined, and carried away.

An adjoining building, of much smaller size, called the pavilion, had already been moved several times as the waters advanced. Small as it was, compared with the hotel, it had been moved in three pieces, having been cut into sections for the purpose. After this experience the most natural idea was to attack the problem of dealing with the great hotel upon a similar basis. It was proposed to saw it into a number of sections, and to move it back piecemeal. The cost of the operation deterred the managers from attempting it.

The hotel is owned by the Brooklyn, Flatbush, and Coney Island Railroad Company. The superintendent of the road, Mr. J. L. Morrow, and the secretary, Mr. E. L. Langford, in discussing the matter, originated the highly ingenious and novel plan which was adopted. Its execution was confided to Mr. Morrow. The plan was to place the hotel upon a number of freight cars, resting on parallel tracks, and to draw it where wanted by locomotives. The nearest approach to such a method is to be found in the Eads ship railroad, and the moving of the gigantic hotel is a happy augury for the success of the other project.

MOVING THE BRIGHTON BEACH HOTEL, CONEY ISLAND.

The building is a wooden structure four hundred and sixty-five feet long, one hundred and fifty feet deep, and three stories high, as regards its main portions. Five towers rise from the roof. Its longer front faces the sea. It had to be moved backward in the direction of its shorter axis. The estimated weight of the structure was five thousand tons. From one hundred to one hundred and fifty tons of plaster were contained within it. It rested upon a series of short posts which, in their turn, were supported by piling.

The first operation was to lay a series of parallel tracks from underneath the building. Longitudinal planks two inches in thickness were placed in the lines where the rails were to run. Upon these the cross ties, or sleepers, were placed, and sand was eventually rammed under the planks and sleepers alike. This gave the sleepers a double support, directly from the earth and also from the stringer planks. The rails were of the ordinary type, weighing fifty-six and sixty pounds to the yard. They were laid with a four foot nine inch gauge rod, and rather freely, so that their gauge was probably five-eighths of an inch more than the normal. The idea of this was to provide for any lateral play that might be necessary. Twenty-four lines of track were laid, and were carried under the building and out from it about three hundred feet landward. To lay track for moving the building its own depth, a mile and a half of rails were required. Ten thousand ties were used.

One hundred and twelve platform cars were hired for carrying the building. They were supplied by the Iron Car Co. Their brake wheels were removed and stowed, each pair under their own car. The building was next attacked in twenty foot sections, and jacked up.

One 90 ton, three 60 ton, five 30 ton, and four 10 ton hydraulic jacks were used. The sills were raised from the supporting posts and the cars were rolled under, carrying with them transverse timbers of 12×14 yellow pine. Each piece rested upon two cars on adjacent tracks, the longest timber being only forty-one feet long. One hundred and ten thousand feet of this timber was required. As far as possible the timbers were made to bear upon the central axis of the car, and over the trucks. The house was raised enough to permit the cars and timbers to go under it, but one or two inches clearance being allowed for. In one place the building had settled nearly a foot. This was straightened up. The cars on each track were coupled together, and then were jacked apart so as to pull out the drawheads to their fullest extent. The weight of the building lowered upon the cars kept them in this position. In some cases this jacking apart was omitted. Such cars were connected by rope slings twisted so as to rigidly hold them together. The idea was to prevent any separation or alteration of the longitudinal distance between cars. No system of diagonal bracing was used, the utmost simplicity characterizing the arrangement.

In sections of twenty feet the whole building was gradually placed upon the cars. It is believed that the strain upon some of them cannot have been less than seventy-five tons, yet nothing has given away, although the springs were strongly compressed, so that the bolsters were nearly in contact.

A number of heavy blocks and falls were now connected to the front ends of the twenty-four lines of cars. As abutment the forward blocks were attached by chain slings directly to the rails. The tackles were arranged so that there were twelve falls, the end of each of which was carried to the motors. A number of thirty-five ton locomotives were on the ground. They were placed upon two tracks, and six ropes leading from the falls were attached to the coupling at the rear of each set of engines. Some of the tackles crossed each other, so that each set of engines had its pulling strain distributed over more than half the face of the building. The strain was taken up on each fall before it was attached. Three tons of rope were used in making these connections. The handling of falls, etc., incidental to their final arrangement was executed partly by a small engine. A man was sent around under the hotel with a steel wire to work the oil and waste well around the journals of the wheels. This was no small affair, as there were nearly nine hundred to be attended to.

When all was ready, the signal to start was given. For the first pull, April 3, the orders were to start the building and then immediately stop. Six locomotives were used. The ropes gradually tightened, and the building without a shake or tremor moved back majestically, and stopped after a short distance had been traversed. A careful examination showed that all had worked perfectly. On the afternoon of the same day a longer pull was given. Then on April 4, with only four engines, the hotel was again moved, and was left two hundred and thirty-nine feet back of its original position. The work now had to stop as far as moving the building was concerned, because the rails were not laid any further and because the piling for the new foundation was not all driven. The rails, sleepers, and stringers left between the house and the water were transferred to the front, and a way provided for the hotel to move the rest of its journey to its new resting place, four hundred and ninety-five feet from its original location.

No difficulty of any kind was encountered. Want of power had been the principal thing that was feared, but four locomotives proved enough to carry the house along at the rate of a fast walk. The engines were found to work admirably in producing an absolute and definite pull. Windlasses or capstans might have been used, but Mr. Morrow felt that they were inferior to the engines, because of the tendency of the rope to slip upon the drum. The total weight moved was placed at one thousand tons for the cars and five thousand for the building. This represents the weight of about one and a half miles of loaded coal cars, or of a large ocean steamer.

Reference has already been made to the Eads ship railroad. In the moving of the great hotel, a far more difficult task than that called for in the operation of the ship railway was accomplished. Instead of a ship, compact and strongly built to resist every kind of strain, a large house, of relatively little intrinsic strength, was dealt with. A little settling or inequality of movement would have wrecked it. As regards power, light locomotives only were used. Compared with an iron, or even wooden, ship, the hotel might be pronounced a house of cards. The confidence in the Eads scheme cannot but be largely increased by this feat in engineering.

Boston Hot Water.

A system of hot water distribution is being introduced in Boston. Thirteen thousand feet of mains have been laid, and lateral connections are in progress. Hot water under a pressure of about 300 pounds to the square inch and heated to 350° to 400° is used. The supply pipes are 4 inches in diameter and the returns 8 inches. These pipes are thoroughly covered by non-conductors of mineral wool and asbestos paper, and rest upon rollers, and also have suitable stuffing boxes at frequent distances to allow for expansion and contraction. The tunnel or subway containing the pipes is surrounded by a double row of brickwork with an air space between, and frequent manholes lead to the surface.

It is proposed to use this system for steam heating, making use of reducing valves to diminish the pressure from the water pressure of 300 pounds to the square inch to some convenient amount, allowing it to expand into steam. The portion of the water which is not converted into steam will be able to return to the system through the large return pipes before referred to. In addition to ordinary purposes for which steam is used, it is the intention of applying it for protection against fire. It is estimated that there are 1,000 buildings within the area selected for the work of the company, and containing 130,000,000 cubic feet of space requiring artificial heat in cold weather. This, in addition to the amount of steam power required for elevators and some minor manufactures, will represent an aggregate of 10,000 horse power from the station.

Naval Carrier Pigeons.

The French authorities are attempting to make use of carrier pigeons for conveying information from war ships at sea to certain stations on land, and with this object have fitted up on the St. Louis a dovecote, painted the most gorgeous colors, in order to permit the birds to recognize their home from a great distance.

HOUSE FOR A KNOLL.

We give a design for a house to stand on a knoll or high ground, by C. T. Beadsley, Jr., architect, of Bridgeport, Conn The arrangement of the interior will be readily understood by a glance at the accompanying plans. Between three and five thousand dollars is an estimate for the cost, depending on the finish.

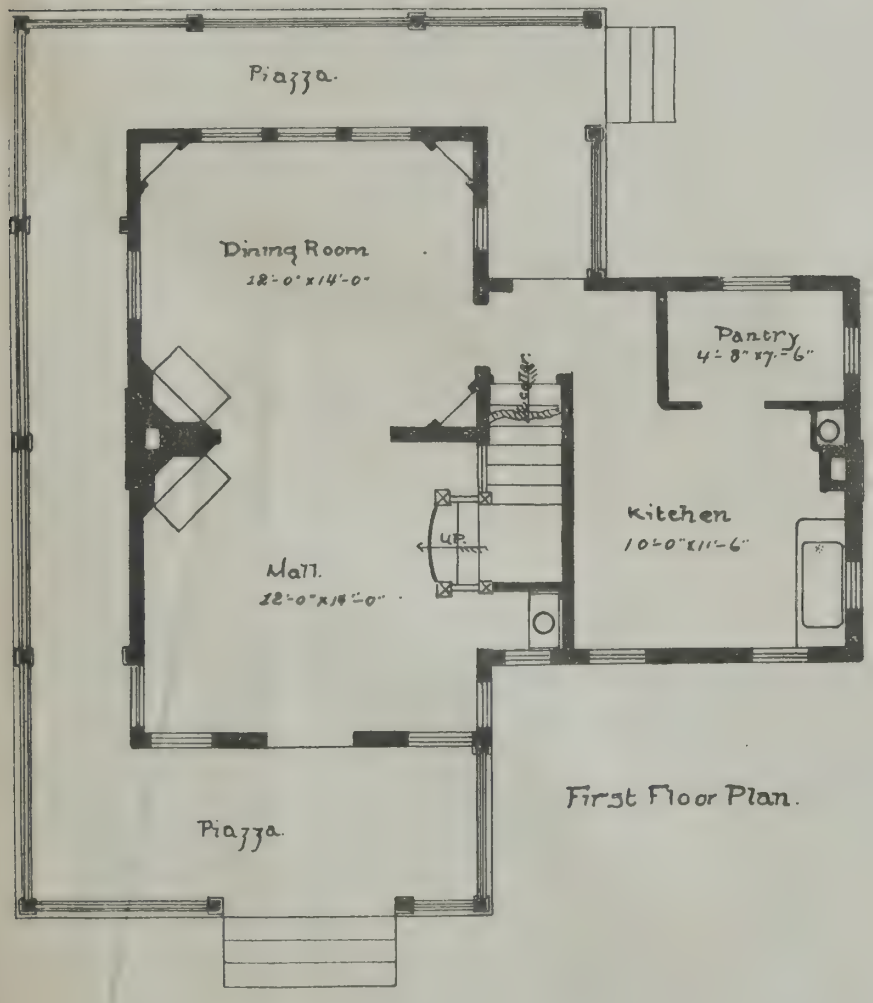
IF any of our readers have made an invention for which they have thoughts of taking a patent, they are invited to communicate with Messrs. Munn & Co., the publishers of this paper, who for a period of forty-three years have conducted a most successful bureau in this line. A pamphlet of instructions will be sent free, containing full directions how to obtain a patent, costs, etc. In very many cases, owing to their long experience, they can tell at once whether a patent probably can be obtained; and advice of this kind they are always happy to furnish free of charge. Address Munn & Co., SCIENTIFIC AMERICAN office, New York.

Roofs for Mills.

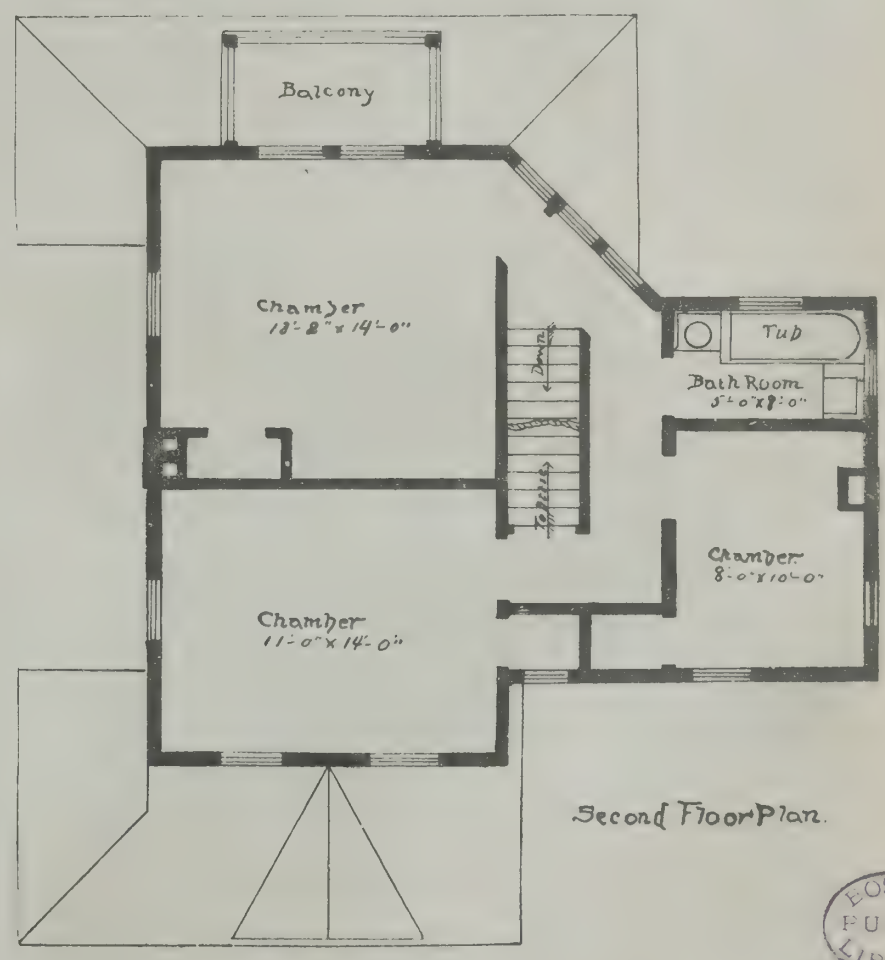
In a paper recently read by Mr. C. J. H. Woodbury, at the Institute of Technology, Boston, a roofing not generally known was mentioned. Mr. Woodbury said that duck roofing has been successfully applied by first laying and tacking down a covering of two ply asphalt paper, and upon this was spread a covering of resin-sized sheathing paper, tacked in the usual manner. Upon this was laid a covering consisting of cotton duck, forty-four inches wide and weighing twenty-six ounces to the yard. He also called attention to the fact that, within a year, paper has been very successfully used as a roof covering. Sheets of wood-pulp board about one-sixteenth of an inch in thickness are treated by a process which renders them hard and elastic, and secured upon the roof by means of tacks through concave tin washers. The edge of each sheet is grooved, in order to allow for the expansion and contraction of the roof. The whole roof is then covered with a heavy mineral paint. His belief that sheet copper forms the most desirable method of covering a roof will be generally indorsed, but, as he remarked, it is costly under present conditions of changes and extensions. The most widely used roofing materials for this class of buildings he considers are either asphalt or the coal-tar roof, the latter being the most widely used in New England. There are numerous varieties of these composition coverings, which are applied by various methods.

As regards shingles, he remarked that they furnish a much better roof covering than slate, both in the matter of conduction of heat or cold in the extremes of summer and winter, and also in resistance to fire. The heat of a slight fire underneath the roof will cause slates to crumble; and the same result will be obtained by heavy sparks falling and burning upon the roof. Some people treat shingles by boiling them under pressure in a solution of salt and chloride of lime, for the purpose of antiseptic treatment, and also to render them fireproof.—*Building.*

THE largest fountain is at Wilhelmshohe, Cassel, Germany. It throws a 12 in. stream 200 ft. in the air.



First Floor Plan.



Second Floor Plan.

HOUSE FOR A KNOLL.

German-American Real Estate Title Guarantee Company.

It is safe to say that the greatest boon ever conferred upon holders of real estate was the establishment of the title guarantee companies. Every purchaser or owner of real estate should promptly give the quality of convertibility to his property by having his title to it guaranteed by a title company. He may then not be compelled to wait weeks and possibly months before any negotiation can be carried through when he wishes to make a transfer or obtain a loan. An owner of real estate, the title of which has been guaranteed by an incorporated company, with a large capital, is protected against possible losses which may be occasioned by error of judgment or oversight of the attorney who made the examination, or by the official searches or by fraud, or by claims which may be made against the property. A policy guaranteeing a title, being transferable, a subsequent purchaser is not obliged, as formerly, to go to the expense and trouble to have the title researched in order to secure his peace of mind, as a title company's policy is the best evidence that the title is perfect.

Of the title guarantee companies, none enjoys a higher reputation than the German-American Real Estate Title Guarantee Co., whose offices are in the Mutual Life Insurance building, No. 34 Nassau Street. Its guarantees are accepted without question by the largest corporations loaning money on bond and mortgage. Thus owners of property can get loans without being subjected to exorbitant charges.

Another saving is made by this company to its clients by the system of private searches, which reduce the item of disbursements more than 50 per cent.

The company attends also to the drawing of contracts, deeds, mortgages, closing of titles, etc., and is prepared to make favorable arrangements with builders and operators.

The company employs for its own protection the best legal talent; the counsel, Mr. Chas. Unarget, enjoys the co-operation of the Hon. Noah Davis, who is the advisory counsel of the company.

Every purchaser of real estate will protect his interests best by having the title examined and guaranteed by the German-American Real Estate Title Guarantee Co., 34 Nassau Street. Branch office, 201 Montague Street, Brooklyn.

A RESIDENCE AT HOLYOKE, MASS.

Our illustration, which is prepared from a photograph, shows the dwelling and grounds of Timothy Merrick, Esq., president of the Merrick Thread Co., at Elmwood, Holyoke, Mass. The beauty of the house and surroundings is quite notable.

A COMBINED RAIN WATER CUT-OFF AND FILTER.

A simple, serviceable, and substantial device for filtering and straining rain water is illustrated herewith, of which Mr. N. W. Davis, of Port Jervis, N. Y.,

DAVIS' FILTER.

is the patentee and manufacturer. Within outer pipe sections is an inner filtering chamber, at the bottom of which is a removable strainer, while near the top is a V shaped strainer, the water from the roof passing down the outer pipe section at the left, as shown by the arrows, up through the strainers and filtering chamber, and down again at the right, through the pipe connecting with the cistern, thus leaving all dirt and other matters in the bottom of the filter. A cut-off valve is arranged, however, near the bottom of the outer pipe section on the side in which the water from the roof enters, on opening which all the water from the roof, as well as all the sediment collected in the filter chamber, are turned down the waste pipe. This cut-off saves all unshipping of leader pipes, by the facility with which water can be turned in or out of the cistern, and the slide cover at the top and removable strainer at the bottom renders it easy to repair or clean any of the parts without taking the filter from its position.

A SIX THOUSAND DOLLAR HOUSE.

The front and back parlors, sitting room, hall, and chamber on second story have open fireplaces. The kitchen and dining room are in the basement, bath room on first floor, five bedrooms on the second floor, attic unfinished, space for two rooms, if required, in attic. Cellar under house. Front 32′, not including the bay in sitting room; side 50′ 6″, not including the piazza; height of cellar 8′, first story 9′ 6″, second story 9′.

First and second stories, clapboarded, roof shingled. Foundation stone. Cost, without furnace and mantels, $6,000.

The Genesis of a Tornado.

The passage from the sand whirls of the streets and other desert places to the tornadoes such as ravage the central part of this country appears at first sight to be gradual; yet, as we shall see, though both depend upon the up-rush of the warm air through the colder overlying mass, the conditions which produce the warmth, and thereby give rise to the current, are not exactly the same. The smaller dust whirls occur everywhere in the world; tornadoes are limited to particular regions, and those of disastrous violence occur only in certain limited parts of the earth's surface. One of their seats of most energetic development is in the central and western parts of the Mississippi Valley. They are peculiarly frequent in the sections from Western Ohio to Colorado, though they occur occasionally in about all the level portions of the central trough of the continent, and also on the Atlantic slope. They happen most frequently in the months of May, June, and July, but they occasionally occur at other seasons; indeed, they have been observed in every month in the year. They are commonest in the afternoons, but have been observed at other times in the day. The way in which these tornado whirls are formed differs in certain essential particulars from the way in which whirlwinds are created, as has been well shown by Professor Ferrel. The most important points of difference are as follows: The dust whirls are due to the heating of a thin layer of air next the ground. The small mass of this layer prevents its upward whirling from bringing about any powerful movements of the atmosphere. In the tornado the heat of the lower air has a different origin. When a cyclone passes over the surface of a country, certain peculiar movements of the atmosphere which it produces bring large volumes of the warm and moistened air to the earth's surface and overlay them by a cool stratum. It is not necessary for us to de-

RESIDENCE OF TIMOTHY MERRICK, ESQ., ELMWOOD, HOLYOKE, MASS.

scribe the exact process by which this condition is brought about; it depends upon rather complicated reactions which take place within the cyclonic whirl. It is sufficient for our purpose to note that in this manner a deep layer of warm air is placed next the surface of the earth, and that it does not owe its temperature in any immediate way to the heat which radiates from the earth's surface. This layer of warm, moist air tends to rise up for the same reason that the thin layer of dry air which forms the dust whirl is impelled upward, but on account of its great mass the intensity of the upward urgence is far greater. In the sand whirl the upward motion begins close to the earth's surface, for the reason that the stratum which is impelled upward is very thin, but in the tornado the stratum of heated air is usually about a thousand feet thick; therefore its whirling action naturally originates at the upper surface of the hot layer, for it is at that point the upward motion begins. Starting in this upper region, the whirl extends progressively downward, just as in the bath tub the whirl extends progressively upward from the point at which the motion originated, until the whirl may touch the surface of the earth. When these whirls begin they only involve a small part of the air about the point of origin, and so the acquired velocity of the particles when they come to the center is not great; but gradually they suck air from farther and farther away. As the field of supply becomes larger, and the particles move from a greater distance, they approach that center with greater and greater speed, and the spiral widens and turns with accelerated velocity. The longer the journey of the particle, the swifter its whirling motion becomes. We may secure a familiar and fairly good illustration of this motion by whirling a weight on a string, and at the same time allowing the string to coil around the finger, thus constantly shortening the length of the circuit the weight traverses. We thus observe that the speed of the motion sensibly increases as the line shortens.

THE WIDTH OF A TORNADO'S PATH.

Fortunately the paths of tornadoes are ordinarily very narrow. The widest have a diameter of less than two miles; the narrowest, only forty feet. In most cases a tornado is seriously destructive over a width not exceeding five hundred feet. The length of the tornado's path across the country does not commonly exceed thirty miles, and it generally traverses the distance in about an hour. When the upward corkscrew motion of the outer part of the spiral and the swifter uprush of the air through the central shaft have drained away the most of the warm air which gave birth to the motion, the tornado dies away. The equilibrium of the air masses is for a time restored, the heavier air has fallen down upon the surface, and the warm air, spreading laterally as it attains the level to which it tends, comes into a state of quiet. Assuming the width of the destruction brought about by the storm at six hundred feet, and the length of its journey at thirty miles, we find that the area of its devastation amounts to about two thousand acres, or to a square area about two miles on a side. Over this area the destruction is ordinarily more complete than that which occurs in the most severe earthquakes.

THE CAUSE OF CYCLONES.

In cyclones we find the largest manifestation of that energy by which the superheated lower air whirls upward from the earth through openings which it has rent in the higher cooler layers In its fundamental cause the cyclone is essentially like both the lesser classes of whirls, the dust whirls and tornadoes, but the field of its work is vastly greater, though the energy which it exercises at any one point is less. The conditions which lead to the formation of a cyclone are as follows: In those heated portions of land and sea where the circumstances permit the air to remain for a long time undisturbed, it becomes very warm and charged with moisture; the hotter it becomes the more moisture it contains, and the less it permits the heat radiating from the surface to pass through its texture; at the same time the upper air, deprived of its usual share of radiant heat, becomes abnormally cold; finally, as in the dust whirls and tornadoes, the lower air breaks through the upper and rushes toward the sky. Although at its beginning a cyclonic storm is probably of no greater size and of much less ascending force than a tornado, there are several reasons which make its history different from that of the smaller whirls. In the first place, the field of heated air which causes the cyclone is far more extensive than that which produces the tornado, though at the same time the difference of temperature between the upper and lower air may be less. The greater bulk of the lower stratum of hot and moist air permits the cyclone to grow larger, but the less ascensional force of the lower air makes it rather less violent in its movements. As soon as the ascending current brings a portion of the heated air from the surface into the higher level it expands, and the force, originally in the form of heat, which kept it in the state of vapor, serves to increase the ascending column just as much as would the direct application of heat sufficient to vaporize the water. Thus we have two sources of force to impel the air in the cyclone upward. Both these forces appear in the tornado, but there the original heat of the lower air is the principal cause of the motion.—*Scribner's Magazine.*

RESIDENCE OF DR. J. S. HURLBUT, ESQ., SCHOOL STREET, SPRINGFIELD, MASS.

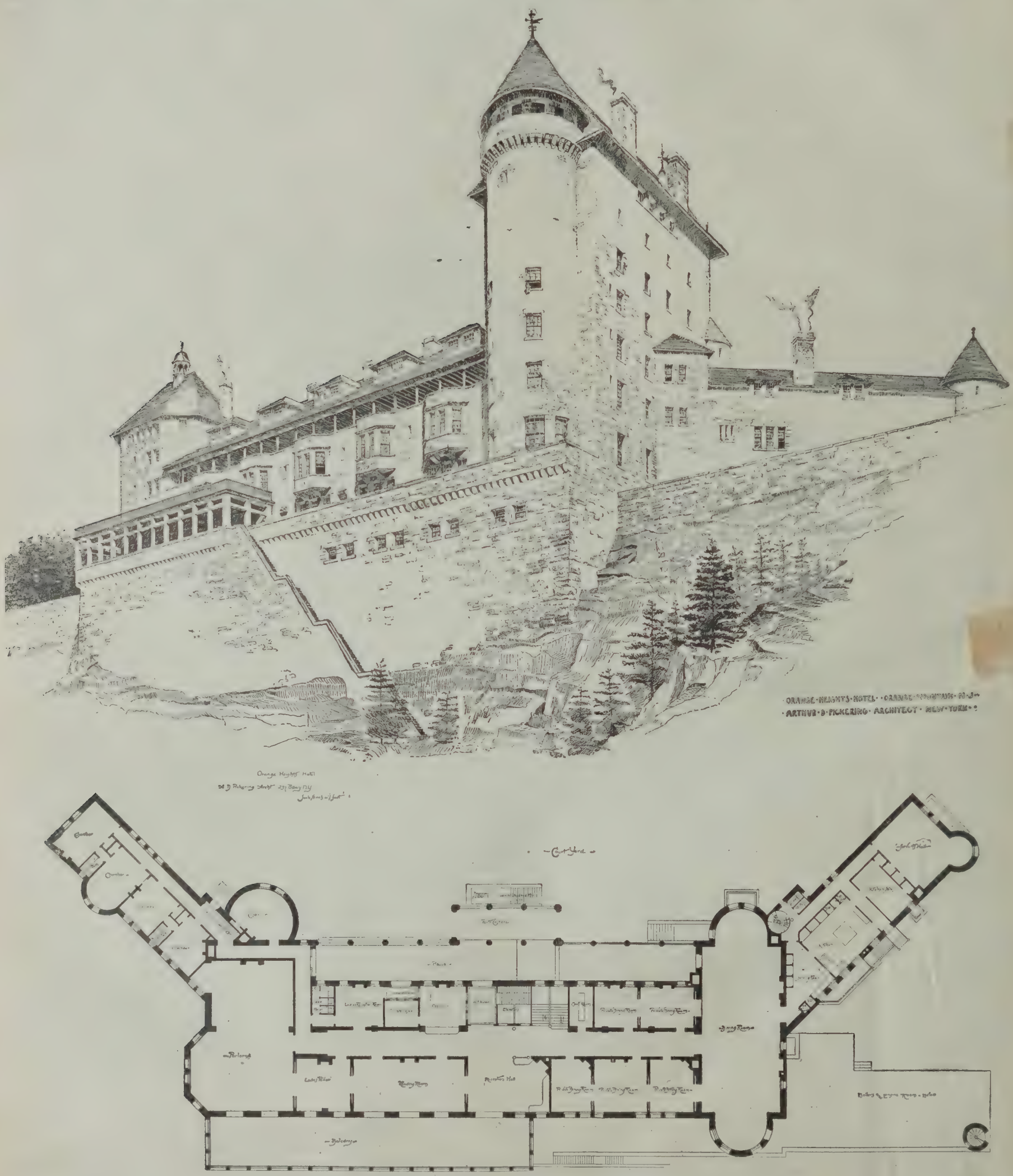
A RESIDENCE IN SPRINGFIELD, MASS.

We give, from a photograph, an illustration of the residence of Dr. J. S. Hurlbut, on School Street, Springfield, Mass. It is a pleasing design.

THE ORANGE HEIGHTS HOTEL.

A very original as well as effective building is the hotel now erecting on Orange Mountain, from the plans of Mr. Arthur D. Pickering. The building surmounts a high bluff with a commanding view of the surrounding country, and is conspicuous for many miles radius. By the ground plan given in connection with the perspective view, it appears that either end of the main building has two bold towers of odd proportions, and from which the wings recede at an angle of forty-five degrees. The bluff is of gray trap rock, at least fifty feet high, dull and somber in color, with which the hotel is in agreeable contrast, being made of a not too warm yellow sandstone, with a roof of a rich red slate, accentuated with cold rolled copper finials and crestings. The small belfry on the south tower will be gilded. The part of the main building facing the court will be built of a common red brick, with trimmings of yellow stone, and the mortar lines wide and yellow. The building is, from both necessity and choice, fireproof, water, in case of fire, being in but limited supply. No wood is used in the construction. The floor beams, window frames, sashes, doors, are iron. Thefloors are concrete and the partitions fire proof brick. The embellishment of the interior is in keeping with the substantial construction and dignified exterior. The main floor is marble mosaic, and all the rooms of this floor wainscoted with rich marbles of different colors and marble trims. All the other rooms in the house are trimmed with Keene cement. A sun parlor, heated by steam and inclosed by glass, extends along the front of the main balcony, with a broad view looking east.

Large balconies are on the third floor, back and front, opening from main halls and also from bed rooms. The belvedere in the north tower, eighty by thirty feet, will be used as a ball room. It has a polished wax floor, laid over the concrete, and with a vaulted ceiling.—*Art Age.*

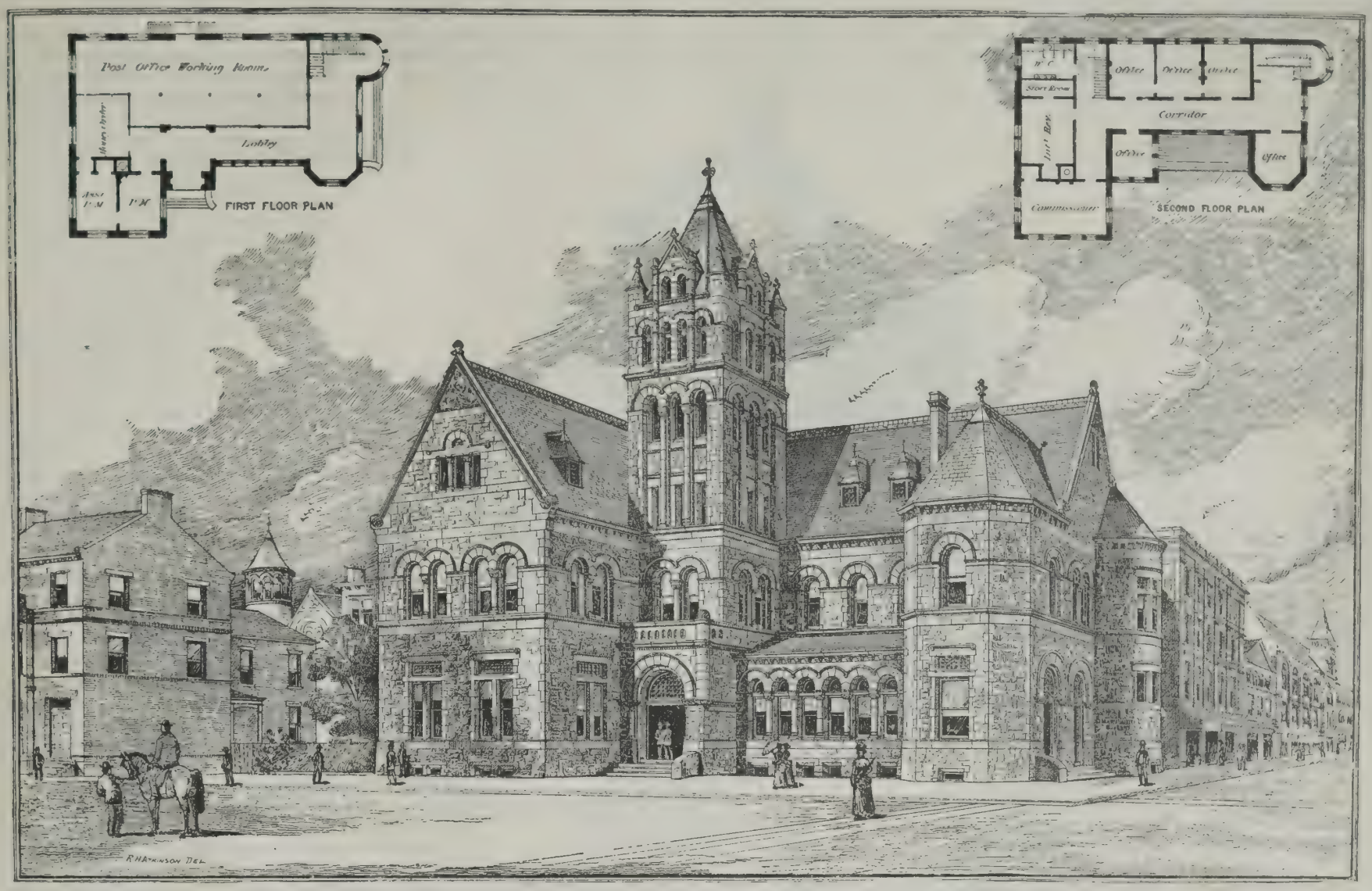


THE ORANGE HEIGHTS HOTEL—ARTHUR D. PICKERING, ARCHITECT.

A Millstone Recipe.

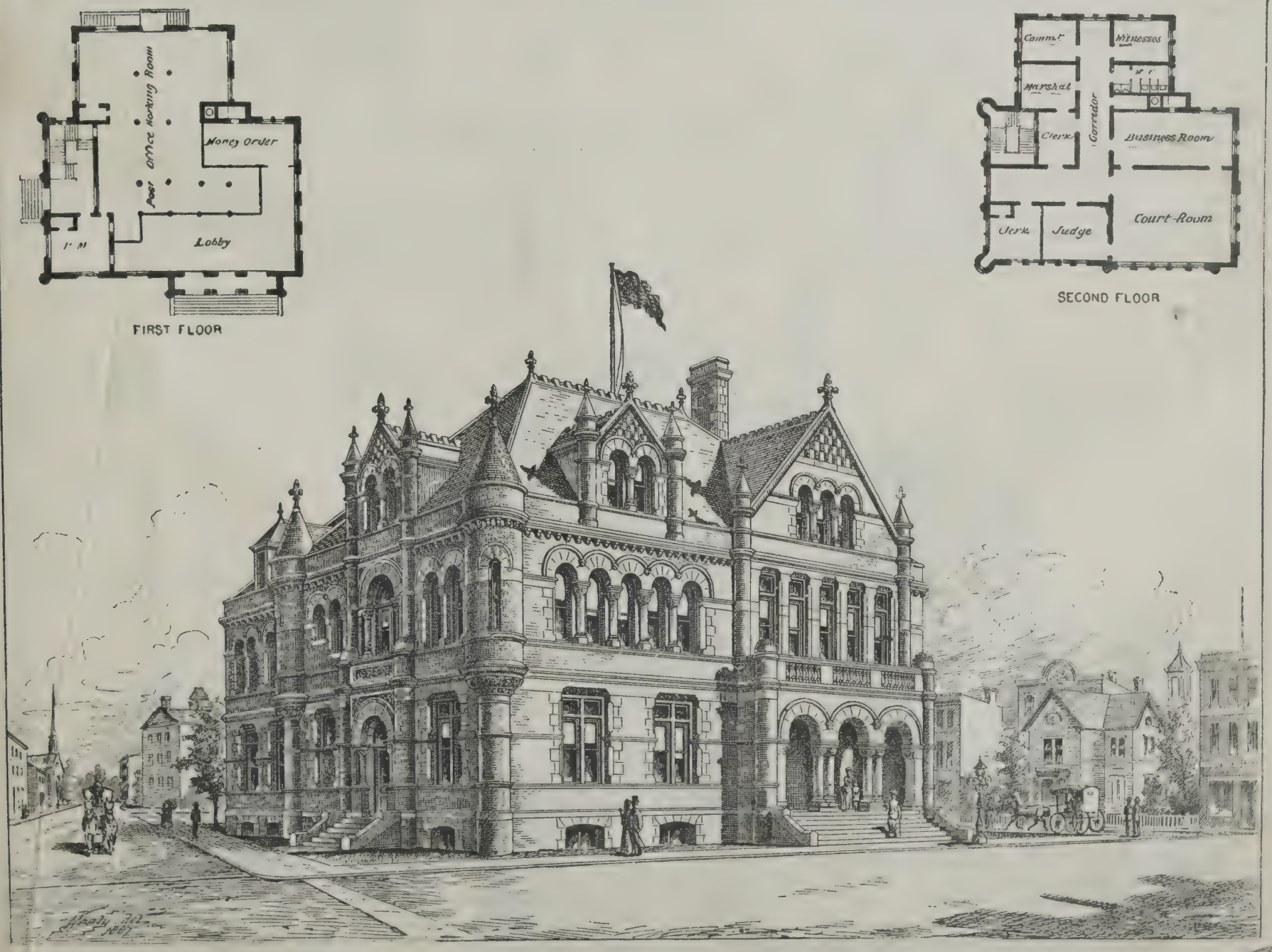
A correspondent in the *Roller Mill*, after using the various mixtures recommended by old millers in the trade journals, claims to have found a better composition than any previously discovered. It resists the wear of the grain, and is but slightly affected by moisture.

Melt a suitable quantity of alum. At the same time place an equal weight of calcined plaster on the stove where it will get quite hot, in order to expel any moisture that may have gathered since its manufacture, and to assist the mass in retaining its heat while being applied. When the alum is thoroughly melted, and hot, drop in as much of the plaster as will mix with the liquid alum without making it thicker than hasty pudding. Then with a flat stick press the mixture while hot into the seams and pores of the burr. After this cement has cooled, take a sharp pick for a chisel and shave down the projecting lumps to the regular level of the stone.



THE NEW U. S. POST OFFICE AT SPRINGFIELD, MASS.

[For description see page 101.]



THE NEW U. S. POST OFFICE AND COURT HOUSE, LOS ANGELES, CAL.

[For description see page 101.]

A DWELLING IN ROCHESTER, N. Y.

We give from the *American Architect* a sketch of a house for Dr. Geo. M. Haywood, Rochester, N. Y., designed by Chas. S. Ellis, architect. The width of the house is 32 ft., length 45 ft., parlor 12×16 ft., sitting room 12×16 ft., dining room 12×14 ft., library 10×12 ft., kitchen 10×12 ft.

We think this dwellling may be erected for about $6,500, without furnace and mantels.

A DWELLING IN ROCHESTER, N. Y.

Lumber Trade Notes.

The log trade of New York is made up of domestic and export orders. Logs for home use are converted mostly into veneers, and there is a decided objection to small, unsound, or crooked stock. The demand is principally for walnut, cherry, poplar and ash, running in volume in the order named. The tendency of oak to split, as well as to contain numerous defects beneath the surface, has led to a decline in the shipment of logs, and the business now is mostly in flitches. In the proper season there is a brisk trade in maple and holly logs. Such logs must be sawed in frosty weather to insure bright stock. The price of logs depends in part on how they are prepared for market. While walnut logs will sell with the bark on, it pays to remove it, and also a slab from the four sides.

Few mill men appreciate the value of painting the ends of logs; but those who do it once invariably follow the plan. The salient benefit of such an expense is the prevention of splits, which lower the grade. When the ends of lumber are exposed, the repeated absorption and expulsion of moisture have a tendency to start a split. A coat of paint prevents absorption and preserves the grade. The lumber saved will pay for the paint and labor twenty times over.

In lumber, especially if high priced, that runs over 20 inches in width, it is well to apply cleats. Counter tops are very scarce and command a high price, and many boards that might have gone into that grade are sold as ordinary stock, simply on account of bad splits. On a single board that it would have cost 2 cents to cleat, 75 cents has been lost because it was not cleated.

The cleat should be a trifle narrower than the thickness of the board on which it is used, and should be nailed on securely, so that it cannot be knocked off in handling. Elm is the best wood for the purpose, but if elm is not obtainable, any tough wood not easily split will answer.

As between band and circular sawed hardwoods, the majority of buyers favor the former. Earlier in the history of the band saw the product commanded a premium, now it is bought as a preference at the same price over circular sawed. In wide stock there is no question as to the superiority of the band, as a top saw on a circular mill produces a ridge on the lumber that injures it for the purpose intended. While circular mills still turn out very choice lumber, it is safe to say that the owner of a good band mill will never return to a circular. The saving in sawdust, which means an increase in product, is a feature not to be overlooked.

In order to manufacture first class lumber, it is absolutely necessary to have a first class mill, which should be set in a thorough manner, to reduce the vibration to a minimum. A great deal depends upon the saw used, and a cheap one that will spring and wabble does as much to spoil the product of good timber as any other one thing in a mill. As a wide run of lumber is a desirable feature of all Eastern markets, it becomes necessary to have a good gang edger. The common practice of edging by turning the log should never be done.

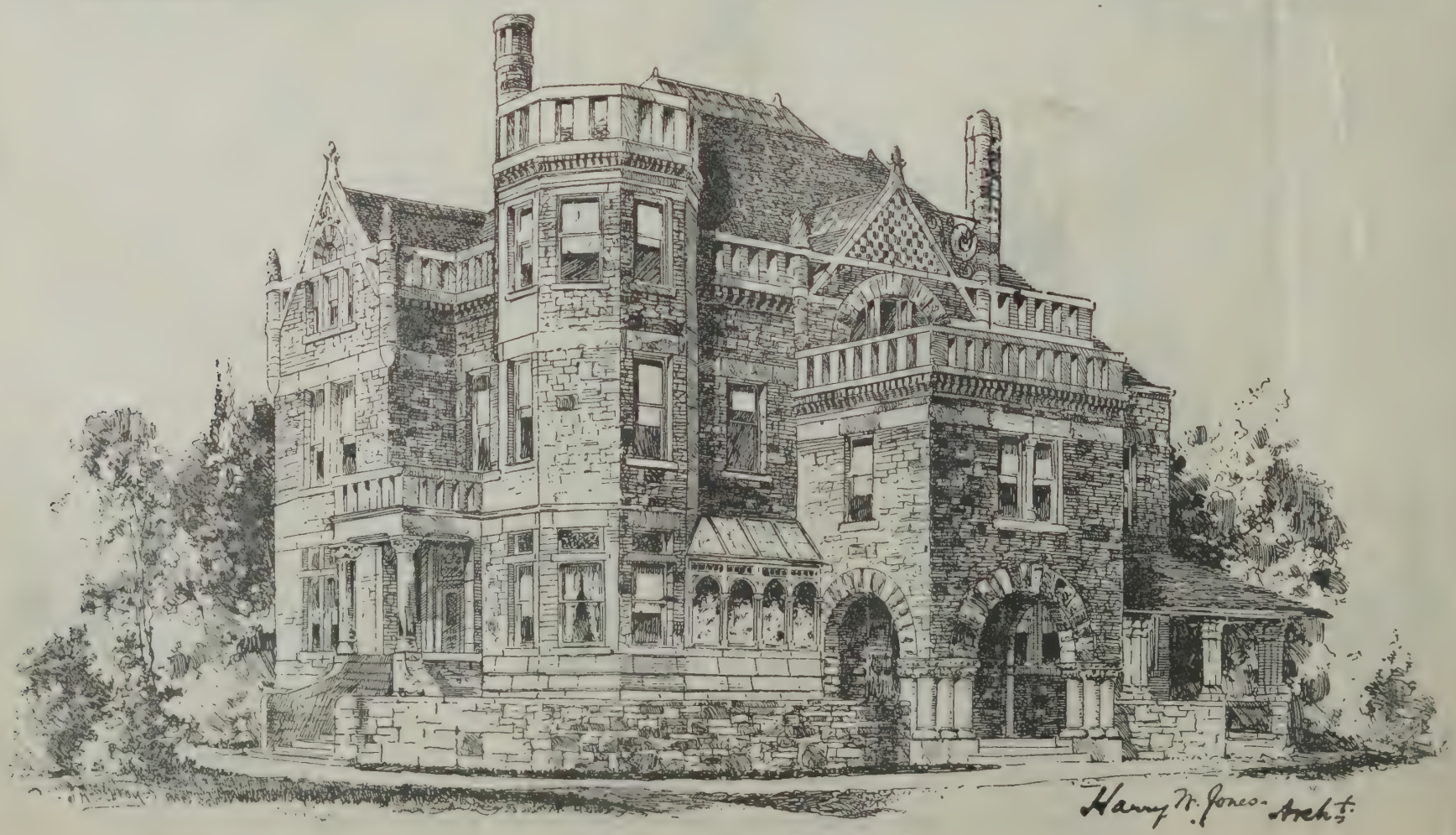
The fact that lumber thicker than an inch commands a trifle higher price in the distributing markets tempts many mill men to saw the largest and best logs into plank, thus sacrificing the quality and width. There are many buyers who would willingly pay more than the ordinary market price for boards, if the quality and width were equal to the average run of good plank. The shrewd mill man aims to saw at least a portion of his logs into extra choice boards—an effort that is rewarded by additional profit and new customers.

All thicknesses of lumber should be sawed "plump," that is allowance should be made for shrinkage in drying. Boards should be sawed not less than $1\frac{1}{16}$ inch, and plank, up to and including two inch, should be one-eighth inch above specified thickness. There is a strong prejudice against thin lumber in the Eastern markets, and if the defect exists, the lumber is measured for the next lower standard of thickness, which subjects a shipper to much loss in quantity.

All kinds of hardwoods should be piled within twenty-four hours after sawed, the same day is preferable. Every thickness and length should be piled separately. All piles should be raised at least 18 inches from the ground, and placed not less than two feet apart. This plan insures a free circulation of air. All piles should be canted toward the back, so that rain will run off and not soak into the lumber. The front stick or crosser should not be over eight feet long (six is better) and four inches wide, and placed so as to project one inch beyond the end of the lumber. This allows just enough moisture to collect to prevent the stock from drying too rapidly on the ends, or faster than other portions of the piece. The crossers or board sticks should be placed four feet apart, and directly over one another. The custom of using boards for crossers is unadvisable, especially if such pieces are green when used. As the lumber dries, every piece where it comes in contact with a wet crosser will stain and possibly mould or rot. Dry board sticks are a good investment. Last of all, when a pile is finished, the top should be protected with a covering made of refuse stock. The best way is to elevate the front end of the roof or covering about ten inches and the back end about four inches. This plan, while admitting plenty of air, will exclude rain and the sky-baking tendency of a hot sun. The covering boards should project beyond each end of the pile about twelve inches.—*N. W. Lumberman.*

A RESIDENCE IN MINNEAPOLIS.

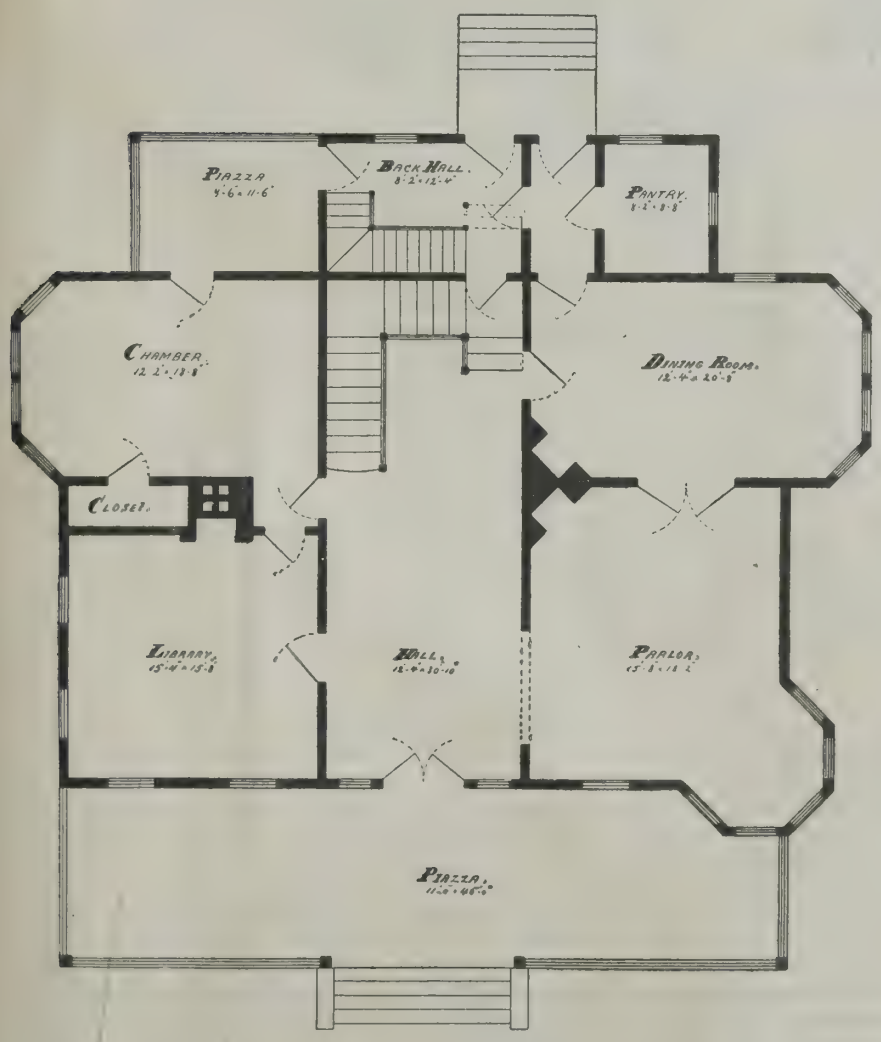
We give a drawing of the residence of Dr. S. F. Hanse, designed by Harry W. Jones, architect, of Minneapolis, Minn. It is a substantial and elegant dwelling. We are indebted to the *Northwestern Architect* for our engraving.



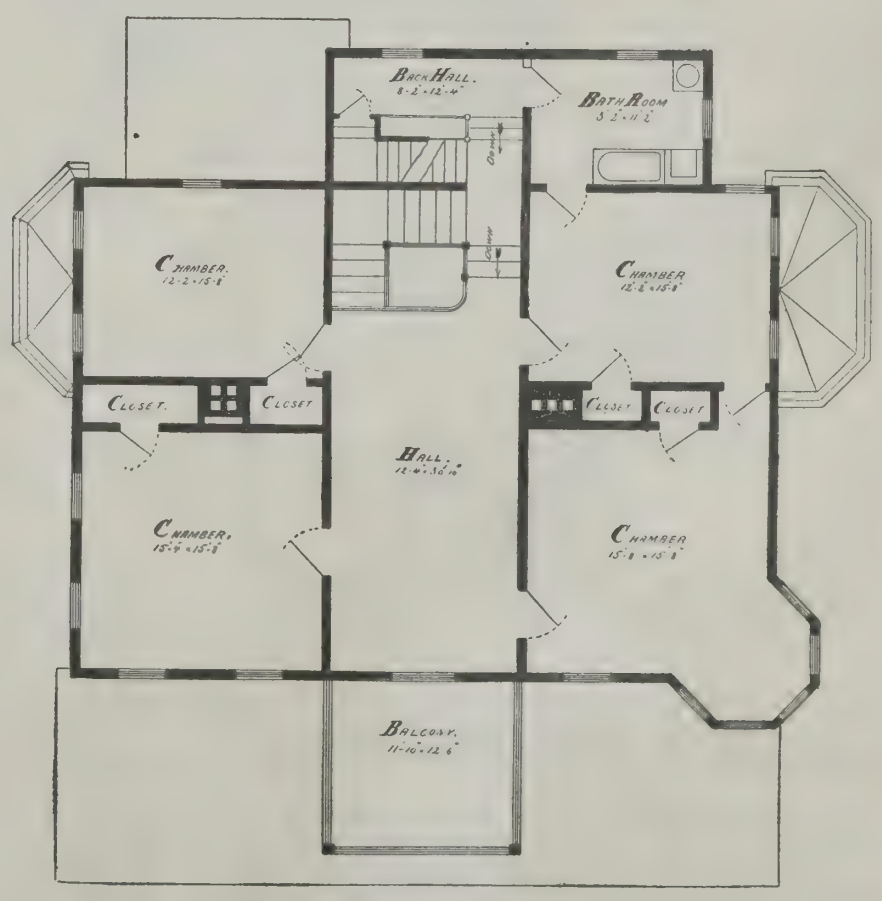
A RESIDENCE IN MINNEAPOLIS.

A COUNTRY HOUSE OF MODERATE COST.

Wide, spacious hall connecting all the rooms, with main stairs located in the rear of all. Large chamber on first floor. The kitchen for this house is supposed to be disconnected. Open fireplaces on first floor. Four large bed rooms, hall, and bath room on the sec



FIRST FLOOR PLAN.



SECOND FLOOR PLAN

A COUNTRY HOUSE OF MODERATE COST.

ond story. The attic at present is unfinished. There could be two nice rooms finished in same.

Size of Structure.—Front, 59'. Side, 40' 6", not including piazzas or bays. For dimensions of rooms see floor plans. Cellar, 7' 6". First story, 10' 6". Second, 10'. Foundation, brick. First and second stories, clapboards. Roofs and gables shingled. Cost, without furnace and mantels, about $6,000.

Warming and Ventilating.

For heating and ventilation of our larger homes, churches, schools, and other public buildings, I know of nothing that can approach the excellent work of the warm air ventilator; not a stove with a big name and placed in the basement, where to furnish its lifeless heated air it must be kept red hot, but a great, big, smiling, good natured iron monster, with avoirdupois enough to hold a constant temperature and lungs and windpipe sufficiently capacious to ventilate with a perfect flood of moderately warmed air, and not by a small quantity of red hot air. Such a furnace will cost considerable for its first cost, but, in the end, think of the saving in fuel, in labor, in repairs, in temper, and particularly in lung tissue, and consequently in life itself. By adequate ducts for removal of impure air, under the control of a suction stack operated by the waste heat of the smoke stack, the ventilation is practically self-acting, the house literally breathes, and good, buoyant, and normal health is the result.

Certainly there is no reason why we should not all have pure air. It is abundant, inexpensive, and obtainable. There is no excuse whatever for the lamentable ignorance that deprives us of this great necessity of life.—*Supt. Search.*

THE world's most complete and valuable gallery of sculpture is at the Vatican in Rome.

DESIGN FOR A FRAME DWELLING.

We are indebted to the *Architectural Era* for the accompanying illustrations of a design for a frame dwelling, the dimensions of which will be readily seen by reference to the scales. The general size is 32'x45', not including veranda. This house can be built for $5,000, and for less in some localities.

Grant Memorial Competition.

1. The Grant Monument Association invites artists, sculptors, and architects, under the conditions hereinafter stated, to submit designs for the monument or memorial building to be erected at Riverside Park, in the city of New York, over the tomb of General Grant.

2. The total cost of the completed structure cannot at present be definitely fixed, but as it is hoped that the funds of the association may be largely increased within the present year, it is suggested that designs be submitted based upon an estimated expenditure of five hundred thousand dollars. Should a larger sum be hereafter contributed, the surplus may be expended in additional ornamentation and decoration, and suggestions embodying such a possibility should accompany the designs.

3. To secure the most imposing and effective results, it is suggested that the designs should combine architecture and sculpture, and that the material to be used should be granite only or in combination with metal.

4. The association will be aided in the selection of the best designs by eminent experts, none of whom shall be competitors or interested in the execution of the work.

5. Each set of designs submitted should be drawn to a uniform scale of one-quarter of an inch to the foot, and should consist of not less than two nor more than four geometric elevations, a plan of each story or division, one or two vertical sections through the center of the monument, and one perspective view correctly projected

6. All the drawings are to be made in lines with India ink and the drawing pens, or simply shaded in ink. No other coloring will be allowed, and *no figures, landscape, background,* or *foreground are to be shown* in either the geometrical or perspective drawings.

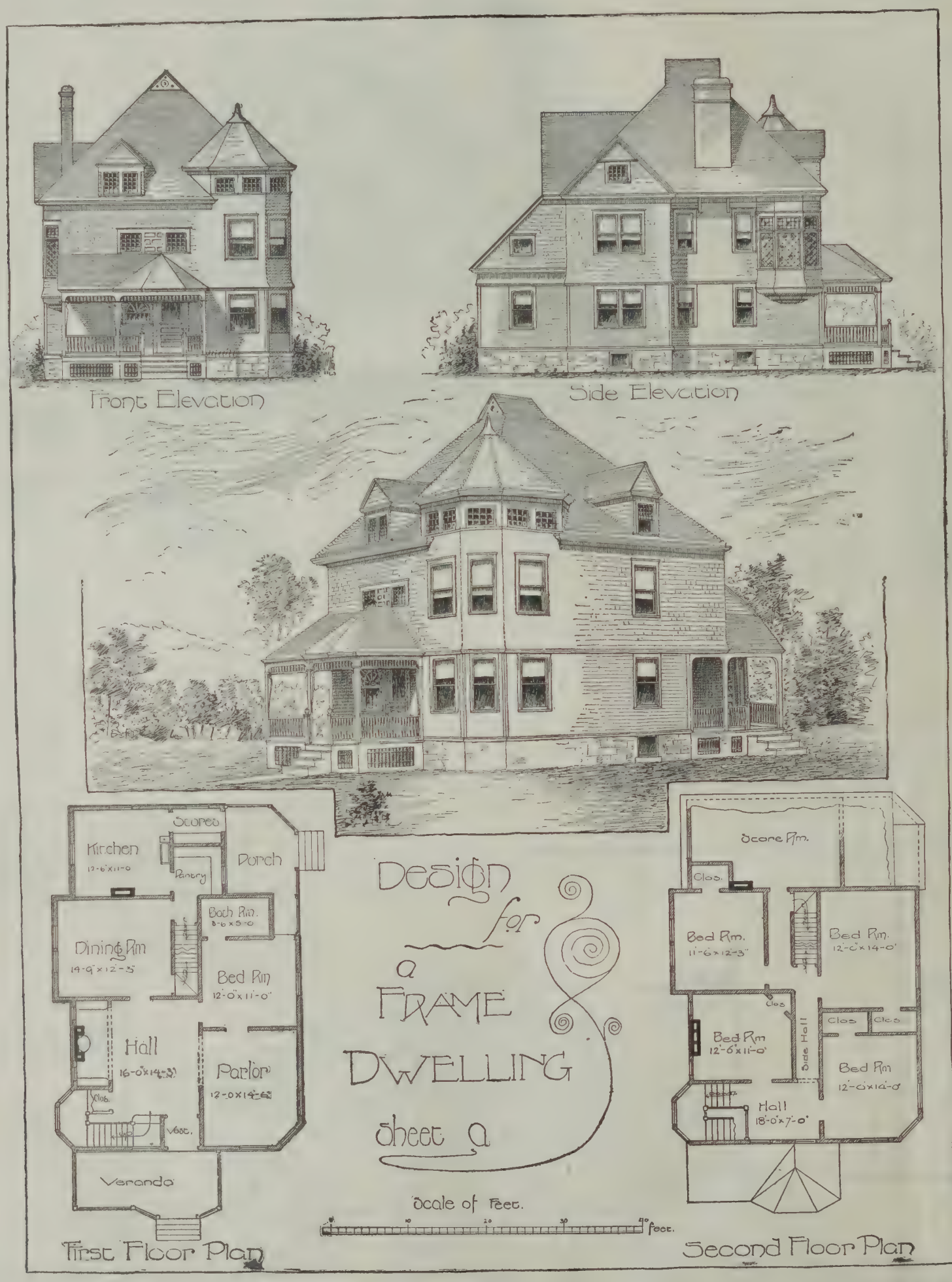
7. None of the drawings are to be framed, glazed, or even mounted upon a cardboard, but are to be put up flat in a portfolio, and not more than one complete set of designs is to be placed in a portfolio.

8. To aid in illustrating any figure or bass-relief shown in a design, models of such, made with plain untinted plaster of Paris, may accompany any design. Such models must be made correctly to a uniform scale of one inch to one foot, and simply illustrate any figure or bass-relief shown in the design. Competitors may also, at their option, submit similar plaster models of the entire structure at a scale of one-quarter of an inch. Models must be securely packed in a case and marked as hereinafter mentioned.

9. Each drawing or model is to be distinguished or marked by a motto or cipher, and no other handwriting or mark of any sort is to be put on them. A sealed envelope, bearing a similar cipher or motto, is to contain the name and address of the author of the design, and he may inclose with it any information in regard to his training, experience, or professional position, and his qualifications for carrying out the designs necessary to the execution of the work, or for conducting the work itself, whether for the architectural portion or the sculpture, to a conclusion, or for both, which he may desire to bring to the notice of the committee.

10. A printed or type-written description of the proposed work, its materials and mode of construction, accompanied with a detailed estimate of its entire cost complete (the correctness of which estimate to the satisfaction of the committee is to be proved and guaranteed before the final adoption of the design), is to be sent with each set of designs, the said description being presented in plain black and white, without any signatures, signs, sketches, or illustrations interspersed, but merely marked with the cipher or motto corresponding to that on the design it describes.

11. All designs, bass-relief models and accompanying description, expressage paid, must be delivered at the office of the Grant Monument Association, —— Street,



New York City, at or before 12 o'clock, November 1, 1888, to which date the time for submitting designs has been extended.

12. The association will select from among the whole number of designs submitted to them the best five and most meritorious, and classify them as first, second, third, fourth, and fifth.

13. The conditions as regards the estimate given for the proposed work having first, however, been satisfactorily complied with, the committee will award a premium of $1,500 to the first, of $1,000 to the second, of $500 to the third, of $300 to the fourth, and of $200 to the fifth, whereupon the said designs shall become absolutely the property of the association, and no allowance or payment will be made for any other design than these five accepted competitions.

14. If the committee do not consider any of the designs submitted suitable and appropriate to the purpose of the monument, they may institute a second competition, which may, at their option, be limited to the five accepted competitors.

15. In the event of inviting a new competition, none of the designs submitted, awarded prizes or otherwise, will be shown to any other competitor or to the public.

16. In case of all rejected drawings, competitors will be permitted to withdraw their offerings as soon as the association has made its selection.

17. Each competitor shall state in his letter accompanying his design what further remuneration he would expect for furnishing all details and superintending the work, should his design be adopted and the committee choose to employ him.

18. This association will not assume any responsibility for the safe keeping, loss or injury, or safe return of any designs, plans, or models sent to them or while in their custody, although all proper care will be taken in every case of the plans, designs and models intrusted to them, and they will be held subject to the demands of the individual competitors. The fact of engaging in this or any subsequent competition is considered as a waiver of all claims for reward or damages against the Grant Monument Association, except as to claims for the prizes already referred to above.

THE GRANT MONUMENT ASSOCIATION.

By order of the Executive Committee,
ALONZO B. CORNELL, Chairman,
RICHARD T. GREENER, Secretary.

New York City, January 26, 1888.

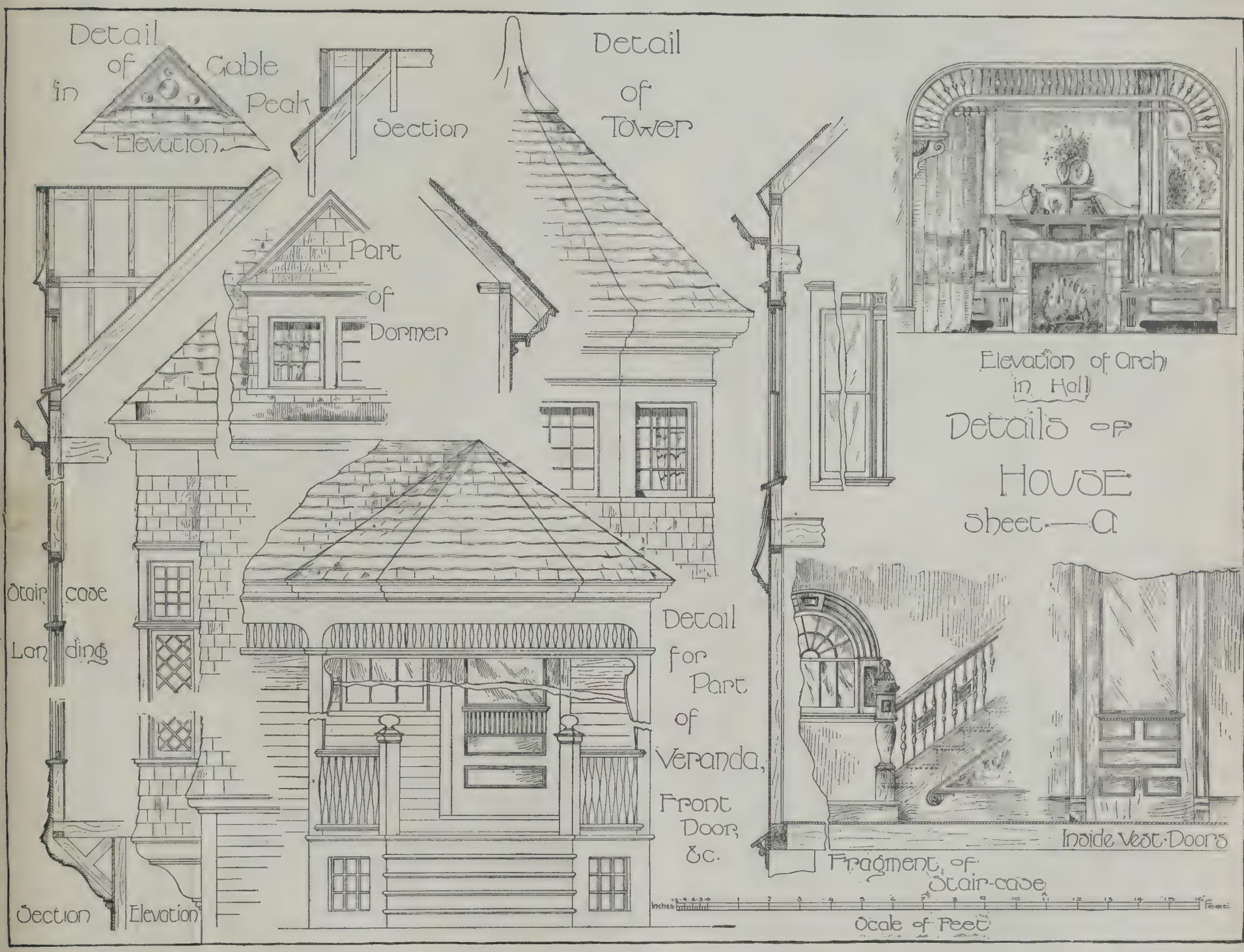
The Arkansas Dry Kiln.

The manner of construction varies somewhat in different localities, but is about as follows: Eight heavy posts, usually 10x10, are set firmly in the ground, reaching about five feet above the surface. On these are placed heavy timbers, forming four bearings, which cover a space 18 or 20 feet square, on which is piled the lumber to be dried. This bench is then covered over with a rough building constructed of unsalable lumber, the sides being 18 or 20 feet high, and roofed with same material, with battens to keep out the rain. An opening is left next the tramway for putting in lumber, and when the kiln is filled the aperture is boarded up.

The lumber, green from the saw, is brought forward on trucks from the mill, and stuck up with narrow strips in the kiln until nearly full. Fires in two spots, without furnace or protection of any kind, are built under the lumber on the bare ground, green pine slabs or soft coal being used as fuel. The green slabs are used to prevent the blaze from reaching the lumber above. The lumber then becomes kiln-dried much in the same way as hams are smoked, and the lumber upon being removed from the kiln has much the same appearance. It requires about one week of careful attention, night and day, to dry from 10,000 to 15,000 feet; and as even small mills cut daily more than that amount, a number of the kilns of the Arkansas pattern are required to reduce their product to the weight required to insure a fair transportation rate to Missouri River points.

The success of these kilns may make our patent dry kiln men green with envy, and it may be interesting to them to know that there is a war of words between the users of the Arkansas kiln as to the relative value of coal and green pine slabs for the cooking process. The slab men claim that the creosote obtained from the slab gives a very rich, harmonious color to the finer grades of finishing lumber, not obtainable by coal or any other fuel. On the other side, the coal men claim that the chances of the kiln (and consequently the mill) burning are greatly reduced by the use of coal, and that if the lumber has not the rich color of the slab sort, there is a possibility, if not a probability, of its being sold for ebony. However, there should be no serious disagreement on this score, as both processes make very black lumber.

Joking aside, it seems ridiculous that such crude ways should exist in this enlightened age, but it is the direct result of the necessity of getting to market in the least possible time in order to insure quick returns with a small outlay of capital. The men using these kilns think it is the only way to compete with the richer concerns who are using modern dry kilns.—*N. W. Lumberman.*



Paint for Fresh Cement.

A process enabling the walls of a house to be painted as soon as the scaffolding is removed is described by the *Bulletin de la Ceramique.* It is known that the free caustic lime in cement saponifies the oil in paint, hence it is necessary to wait until it is changed into carbonate of lime before painting with oil. To save this time a process was adopted in painting the Berlin War Museum in which casein was utilized. The composition was formed of three parts cheese and one part slaked fat lime stirred together. The color was added according to requirement. Only earth colors or oxides are to be used with the composition for light red and dark brown shades; for blue, ultramarine or cobalt; for white, oxide of zinc or sulphate of baryta; for black, animal black. White lead, vermilion, aniline, aniline prussian biue, vermilion, or blue ocher would not be used. The paint prepared by the composition does not take fire readily, and hence is suitable for theaters,

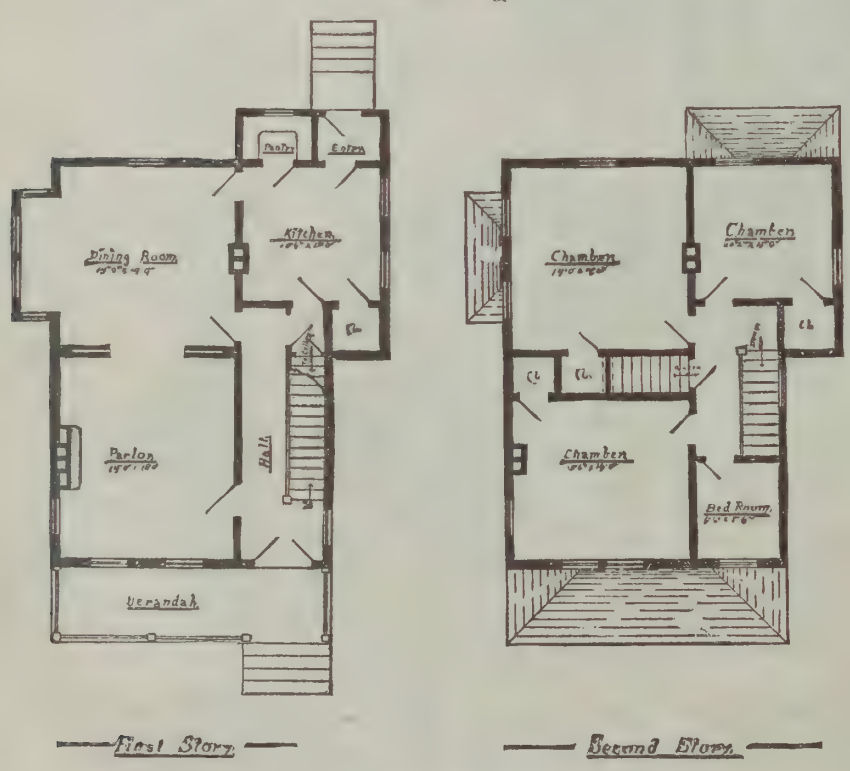
A $1,500 COTTAGE.

The accompanying illustrations give a perspective view and floor plans of a cottage designed by David W. King, architect, for a suburban town within easy traveling distance of New York City. It requires a lot with a frontage of not less than from forty to fifty feet, and should be placed back from the street about twenty feet, with the ground slightly raised near the house, in order to have it show to advantage.

There is a cellar under the parlor and hall only, the remainder of the space under the building being unexcavated. The cellar is six feet six inches in depth, with eight inches hard brick foundation walls, resting upon eight inches by sixteen inches concrete footings. The depth of the footings in the cellar is ten inches below the level of the cellar bottom, in other places three feet below the grade line.

The chimneys of selected hard brick, resting on concrete foundations ten inches thick, and projecting not less than four inches from the face of the brickwork on all sides.

The first story is eight feet eight inches in height in the clear, and contains a parlor twelve feet by fifteen



A $1,500 COTTAGE.

feet; dining room, twelve feet by fourteen feet; kitchen, ten feet by eleven feet, with a pantry and closets; main hall and veranda. The second story is eight feet in height, and contains four rooms and three closets, with stairway to attic. The first and second stories are hard finished, on one coat of hard mortar and well seasoned lath. The attic unfinished with the exception of a floor.—*Building and Loan News.*

In connection with the publication of the Building Edition of the Scientific American, Messrs. Munn & Co. furnish plans and specifications for buildings of every kind, including Stores, Dwellings, Carriage Houses, Barns, etc. In this work they are assisted by able and experienced architects. Full plans, details, and specifications for the various buildings illustrated in this paper can be supplied.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address Munn & Co., 361 Broadway, New York.

Foreign Made Joinery.

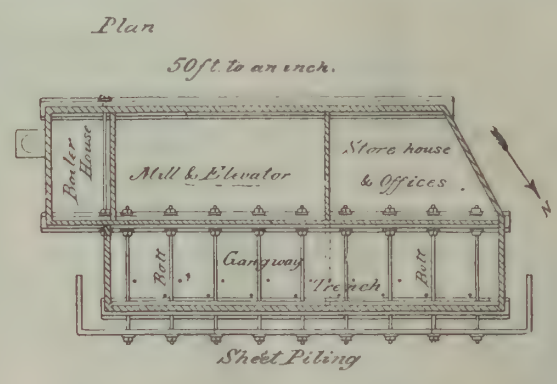
Very large importations of American and Swedish joiners' work take place, the qualities of which are various. Unfortunately, the great demand for this class of goods has brought into the market inferior kinds, against which the architect ought to be on his guard. As a general rule, American and Swedish joinery is chiefly used by builders who enter into large speculative undertakings, their main inducement being to obtain the cheapest description of joinery. The saving, of course, is material when a number of houses are built having doors, windows, and other fittings of the same dimensions. The American manufacturers study the English wants in these particulars, and make exactly the class of goods that suit builders of this kind. A good 1½ in. four-panel moulded door, 2 ft. 8 in. by 6 ft. 8 in., can be had for 12s. or 13s.; a 2 in. four-panel moulded door for 16s. or 17s.; and a sash and frame with 1½ moulded sashes, size 3 ft. 6 in. by 6 ft. 2 in., for 15s. Now, a four-panel moulded and square door, 1½ in. thick, would cost quite double the price if made here, and if we compare the trade prices of home manufacture, we shall find at least a saving of 50 per cent. by using the American or Stockholm joinery. The prices quoted for Stockholm joinery at the London depot are even lower; thus a 1½ moulded and square door, 6 ft. 8 in. by 2 ft. 8 in., is priced at 10s. 2d. in Laxton Both classes of joinery are of superior quality if obtained through the proper channels. The Stockholm goods are supposed to be made from the best Baltic timber, but of this we have no guarantee. New Brunswick, in the Dominion of Canada, turns out some excellent woodwork. The woods are various and form cheap steam producers, so that a great saving is insured by its manufacture in the place of its growth. Importation of the raw material in logs to be turned to account here must be productive of considerable waste in the processes of conversion, sawing, and planing.

The question of foreign made joinery is one that is daily forcing itself more upon the building world. High class workmanship is at a discount just now, and even architects are favoring the foreign goods, notwithstanding the admitted disadvantages that accrue to home trade. The architect, if he respects his traditions, at least, must regret anything that tends to discourage the craftsmen at home by importing manufactured goods, and he is certainly justified in requiring a high standard. The one drawback of wholesale mechanical production is the loss of good design and workmanship. The same mechanical mouldings are repeated *ad nauseam;* every door is alike, the same moulding round the panels, the same regulation architrave moulding round doors and windows, till the eye becomes tired of the repetition. Even such a thing as variety in doors and mouldings is a relief in a house—especially a large one—a slight difference in the framing and panel, in the mouldings on both sides of a door, or in the architraves. In a large door we expect to see a different treatment, a wider architrave, bolder or more elaborate mouldings, than in one 2 ft. 8 in. wide. The speculative builder who introduces foreign joinery makes these finishings all alike, and the same mouldings are put everywhere—round the small closet door or window and round the drawing room or front door. It would be to the interest of the art workman at home, as well as the importer of foreign goods, if architects were more exacting in their tastes by requiring their own designs to be worked to, instead of too complacently submitting to the taste and pockets of the producers of machine joinery on the other side of the Atlantic.—*London Building News.*

There was recently received from China a sheet of paper made from the web of the "sacred white spider," and on it was printed in English a story of about 3,000 words.

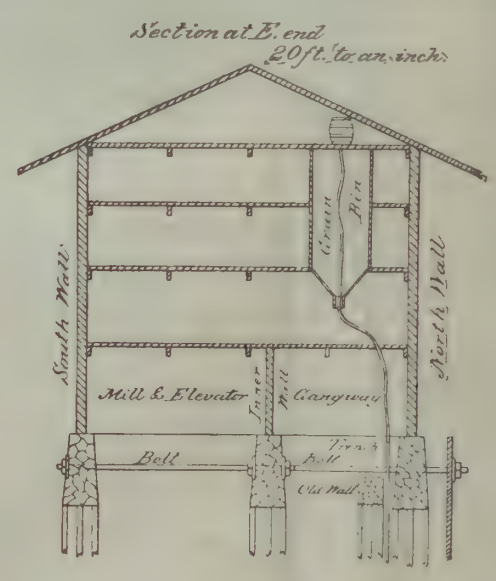
Repairing of Foundation Walls.

An interesting piece of engineering work has been recently completed at the Columbia Elevator, Providence, R. I. It consisted in constructing a new foundation wall under a large, substantial brick building without seriously disorganizing its internal arrangement, and without great expense. The building consists of a brick storehouse and, separated by a brick wall, a wooden granary (slated), with the two lower stories which are used for milling purposes, built of brick. Serious cracks had occurred in the brick walls in the north and east sides of the building, containing the milling and granary departments, which made it evident that steps should be taken to prevent the structure from falling about the ears of the occupants. Upon examination it was found that the ground where the building was erected, and which formerly was a low marsh, was so springy and soft that the wash from the steamers constantly coming into an adjoining slip, and the movement of the tides, had affected the stability of the piles upon which the foundation wall had been erected. The dredging carried on in the harbor had also added its share of the work of destruction. The



piles were pushed out under the thrust caused by the weight of the building, and, not having any backing at the top to hold them, cracks large enough to receive the doubled fist had appeared in the brick walls.

The work of reconstruction was put in the hands of Mr. J. Herbert Shedd, C.E., and the general plan decided upon was the laying of a concrete bed under the wall, and its subsequent rebuilding while the structure was temporarily sustained on beams and jack screws. The first steps taken were the building of a bulkhead almost parallel with the north wall, of sheet piling, made up of sticks of Southern pine, 8 inches thick by 12 or 14 inches wide, and about 30 feet in length. Each stick was grooved to receive a 2 inch spline, and, in order to drive each pile as close as possible to its neighbor, the side next to the adjoining pile was beveled, thus assuring its close contact. The spline was driven



after each pile, serving as a guide for the next, and rendering the wall more solid and tight. The piles were held while being driven by two stringers, which were used as guides. Both the hydraulic system and the steam hammer were employed in driving the piles. As may be seen by examining the plan, the piling was turned in at each end to prevent the inflow of water at these points.

In order to tie the bulkhead firmly in position, 3 inch iron bolts were passed through the north and the inner walls at intervals of 16 feet, thus binding the piling firmly in place. At the east end, where the thrust was greatest, a supplementary bolt was used, which passed through the entire building to the south wall, thus bringing the strain equally on the whole building.

After a piece of the sheeting was finished, concrete (1 part hydraulic cement, 2 parts of sand, and 3 parts of gravel) was run in between it and the foundation wall. This filled the larger cavities, and, forming a wall with the sheeting, made a water-tight bulkhead. A trench was dug on the inner side of the foundation wall to enable a 20 foot 4 inch pipe to be sunk, through which cement was to be forced to supplement the work that was not completed on the outside.

In order to procure enough head to force the cement

through the pipe, the concrete, consisting of 1 part hydraulic cement and 1 part of sand, was mixed on the fourth floor of the building, at which elevation it was fed into a hose which connected the receiving tank with the pipe in the trench below. This pipe had a head with a hose coupling on the top, and a valve to be opened to relieve undue pressure. Enough water was used in sinking to keep the head free of mud. As the concrete was forced out of the pipe, it spread out, filling the mud cavities under and about the wall, and setting about the old piles, driving the light mud and sand ahead of it, and gradually taking its place. As the cement was very heavy and sank under the pressure, the lighter materials were forced to the surface, partially drawn up as the filling progressed caused great inconvenience, but this was remedied by swinging the receiving tank and its platform so that it could be raised and lowered as required. Only the best quality of hose could stand the wear and tear and the weight of the material when the pipe became clogged. It was found convenient to use short pieces of irregular length, which rendered it easy of repair. The pipe was sunk at intervals of about eight feet, about twenty feet behind the place where the driving was going on. After the concrete hardened, the work of repair became similar to that usually followed in building new foundations under old houses, which has been often described in these pages. Beams with jack screws

PROVIDENCE, R. I.—REPAIRING THE FOUNDATIONS OF A LARGE GRAIN MILL AND ELEVATOR.

where they could be easily removed. When the space about the bottom of the pipe became filled enough to stop the flow, the hose was filled with clear water to the top and allowed to stand. Sometimes, however, the pressure would break out in a new channel, and then filling would be carried on again. After the concrete had thoroughly set, the pipe would be lifted and the concrete would begin to flow again. The work was carried on in this way until the concrete had been filled in to the required height, when the pipe would be removed and the cavity filled in from the surface with grout. It was necessary to have the line from the barrel to the pipe as straight as possible, with no sudden bends or sags for the material to collect in, as it sets very quickly under pressure. During early stages of the work, the sag of the hose when the pipe was under them were erected upon the concrete and the piling, and these were made to carry the weight of the building, when the wall, as well as that of the lower story of the building, was taken down, as far as the level of mean high water, and the foundation and wall above were then rebuilt on the new and solid bed.

Floor Paints.

Another practical suggestion relates to the painting of floors. It seems that any color containing white lead is injurious to wood floors, rendering them softer and more liable to be worn away. Paints containing mineral colors only, without white lead, such as yellow ocher, sienna, or Venetian or Indian red, have no such tendency to act upon the floor, and may be used with safety. This quite agrees with the practice common in this country of painting kitchen floors with yellow ocher or raw umber or sienna. Although these colors have little body compared with a white lead paint, and need several coats, they form an excellent and very durable covering for the floor. Where a floor is to be varnished, it is found that varnish made by drying lead salts is nearly as injurious as lead paint. Instead of this, the borate of manganese should be used to dispose the varnish to dry, and a recipe for a good floor varnish is given. According to this, two pounds of pure white borate of manganese, pounded very fine, are to be added, little by little, to a saucepan containing ten pounds of linseed oil, which is to be well stirred, and gradually raised to a temperature of three hundred and sixty degrees Fahrenheit. Meanwhile, heat one hundred pounds of linseed oil in a boiler until bubbles form; then add to it slowly the first liquid, increase the fire, and allow the whole to cook for twenty minutes, and finally remove from the fire, and filter while warm through cotton cloth. The varnish is then ready and may be used immediately. Two coats should be used, and a more brilliant surface may be obtained by a final coat of shellac.—*American Architect.*

NEW GOVERNMENT BUILDINGS.

Our illustrations on page 95 show the new post office at Springfield, and the new post office and court house at Los Angeles, Cal. Will. A. Freret, supervising architect. We are indebted for our drawings to the *American Architect and Building News.*

A SUBSTANTIAL DWELLING.

The rooms are of good size. Open fireplaces in all the principal rooms and halls on first story, and three open fireplaces in the second story. Two rooms can be finished in attic if required. Cellar under the whole house. Dimensions: Front, 45′. Side, 35′, not including piazza. Cellar, 8′ high. First story, 10′. Second story, 9′ 6″. Foundation, stone. First story, stone and wood. Second story, shingles. Roof, shingled. Cost, without furnace or mantels, $8,000.

Large Dams.

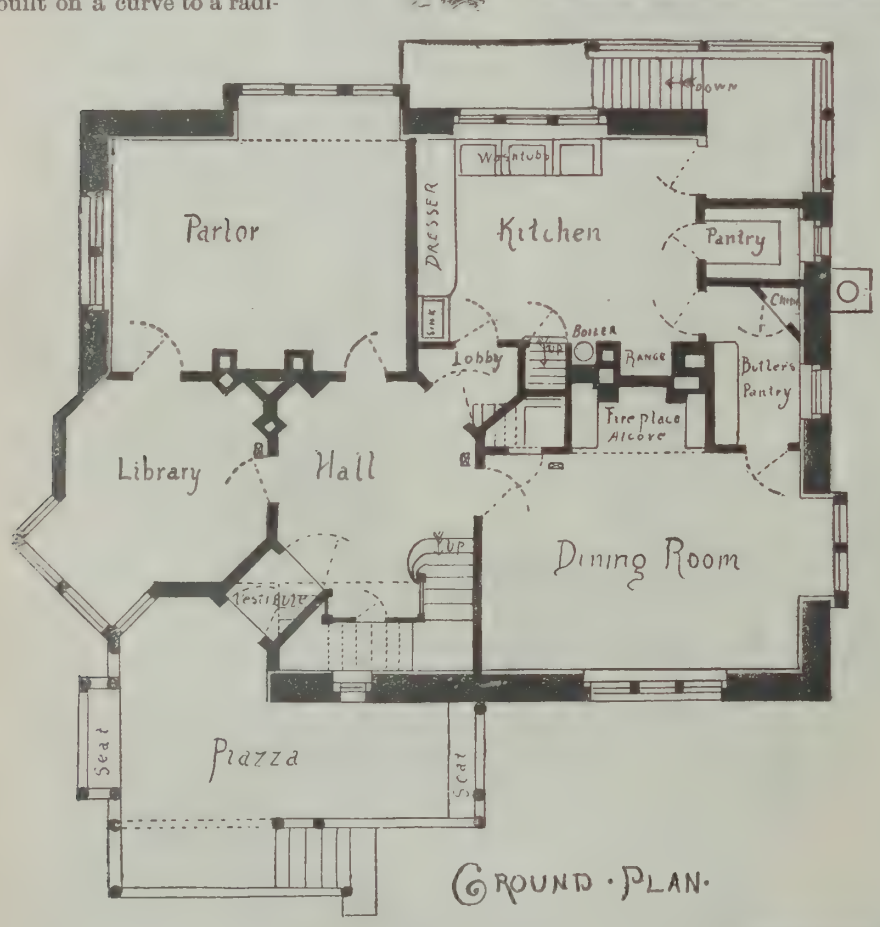
Several remarkable examples of masonry dams are recorded. That of the Furens, in France, for the St. Etienne Waterworks, designed by Graeff & Grandchamps, is curved in plan; the radius of curvature is 828 ft. from a center on the down stream side. It is founded upon compact granite, the footings carried down 3 ft. 3 in. below the surface of rock. The construction is of rubble masonry in hydraulic mortar, in courses of 5 ft. in depth. The height of the dam is 170 ft. on the up stream side and 184 ft. on the down stream side. It has a breadth at the crest of 9 ft. 8 in. and 110 ft. at the base. The cross section is so designed that the pressure is nearly constant in all parts, and nowhere exceeds 93 lb. to the square inch, or 13,392 lb. to the square foot. Reservoir capacity equals 352,000,000 gallons. The Villar dam, Madrid, on the river Lozoya, has an immense storage capacity—4,400,000,000 gallons. The height of the dam is 162 ft., breadth at the crest 14 ft. 9 in., and is built on a curve to a radius of 440 ft. It is 540 ft. in length, and is constructed of rubble masonry in hydraulic mortar.

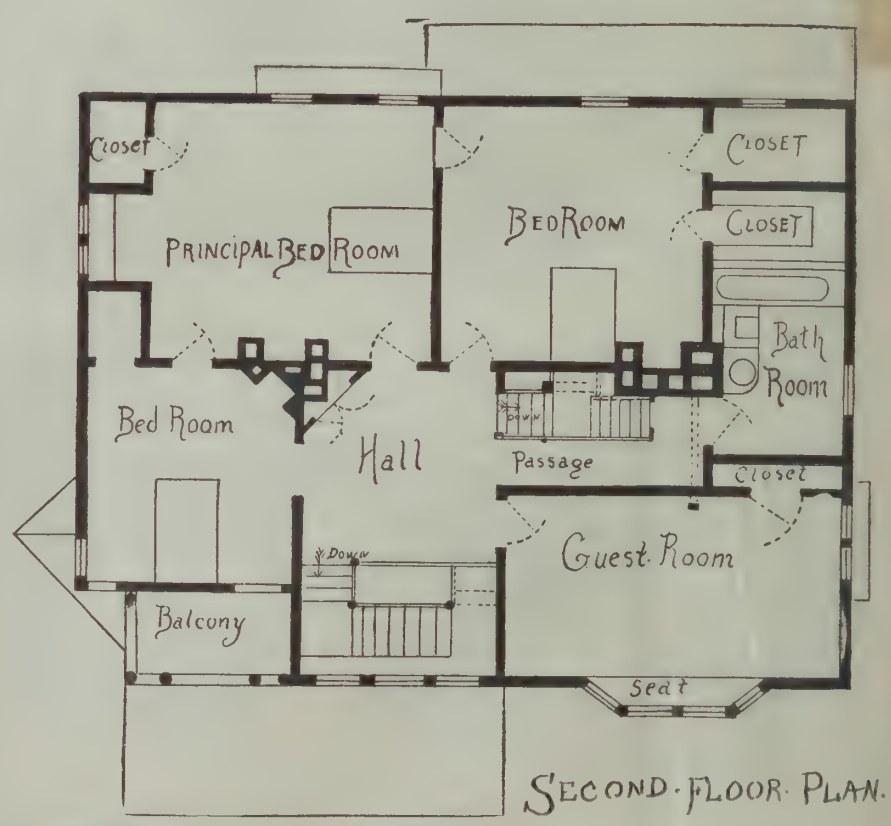
In New South Wales, the Paramatta dam is also built of masonry on the curve, and has resisted a flood of water 4 ft. depth over the crest. The Stony Creek reservoir dam of the Geelong Waterworks, Victoria, is constructed of concrete in the proportion of 1 to 8½. The plan is curved to a radius of 300 ft., and the greatest head of water is 52 ft. 4 in.; the width of crest is 2 ft. 8 in., having a heavy coping of bluestone. The Croton reservoir dam, New York, is built in hydraulic mortar, 78 ft. in height; the face walls are of stone courses 14 in. to 26 in., vertical on the up stream side, with a batter 1 in 2½ on the other; the core is of concrete for a depth of 45 ft. from the top, the remaining depth being of rubble.

One of the largest dams projected is the Quaker Bridge dam, on the Croton River. It is designed to be 1,300 ft. in length, 170 ft. in height, with a crest of 26 ft. broad and a base of 216 ft. The capacity of the reservoir will be 32,000,000,000 gallons. The section of this dam is nearly vertical on the up stream side, and is battered to about two thirds of its height on the other. Curving a dam so that its convex side is presented to the water pressure adds greatly to its strength, but the great variety of cross sections and batters in the masonry dams constructed show that engineers are still without any definite rule in designing these structures.

Quick Work.

The Kansas City *Times* gives the following record of tests recently made, showing to what a fine point the department in that city has got quick hitching: Hose reel No. 6—Horses in stalls fourteen feet from end of tongue, in one and one-fourth seconds from tap of gong. Same company, men in bed: Complete hitch in one and three-fourth seconds. No. 1 Hook and Ladder—Men in bed, lead team sixteen feet from collars, wheel team twenty feet from end of pole, hitch made in seven seconds. The floor hitch was made in three seconds after men came down the pole, the four seconds being required for dressing. No. 3 hose reel made a floor hitch, the horses running thirty-six feet in two and one-half seconds.





A SUBSTANTIAL DWELLING.

Preservation of Timber.

Never apply paint or any other coating to green or unseasoned timber.

If the wood was not well dried or seasoned, the coat will only hasten decay.

Good coatings consist of oily or resinous substances, which make a smooth coat, capable of being uniformly applied; they must cover every part, must not crack, and possess a certain amount of plasticity after drying.

Coal tar, without sand or plaster or pitch, especially if mixed with oil of turpentine and applied hot (thus penetrating more deeply), answers best. A mixture of three parts coal tar and one part clean, unsalted grease, to prevent the tar from drying until it has had time to fill the minute pores, is recommended. One barrel of coal tar (three to four dollars per barrel) will cover 300 posts. Wood tar is not serviceable, because it does not dry.

Oil paints are next in value. Boiled linseed oil or any other drying vegetable—not animal—oils are used, with lead or any other body (like pulverized charcoal) to give substance. Immersion in crude petroleum is also recommended.

Charring of those parts which come into contact with the ground can be considered only as an imperfect preservative, unless a considerable layer of charcoal is formed, and if it is not carefully done, the effect is often detrimental, as the process both weakens the timber and produces cracks, thus exposing the interior to ferments.

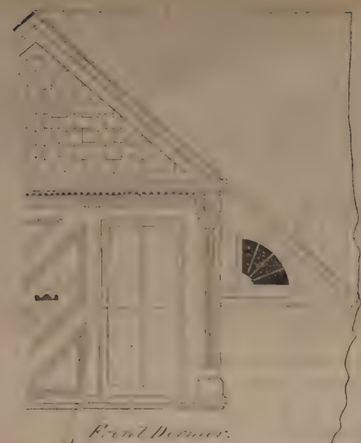
Lastly, in communities where durable timber is scarce, it will pay to establish a plant for impregnating timber with antiseptics.—*Norman J. Colman, Commissioner of Agriculture.*

Enemies to Varnish.

Although painters and carriage makers, as a rule, are perfectly conversant with the destructive influence of ammonia on varnish, it seems as though it were going to be an interminable undertaking to convince their customers—the reckless, careless, thoughtless carriage owners—of the importance of using means to prevent such unnecessary destruction. Various plans have been suggested to remedy the evil; but, up to date, about the only sure way—the only way that can be recommended with perfect confidence—is to keep all varnished work in a separate building from that in which horses are kept. The atmosphere in the carriage room should be moderately warm and quite dry. Cold itself has a serious effect on varnish.—*Painters' Journal.*

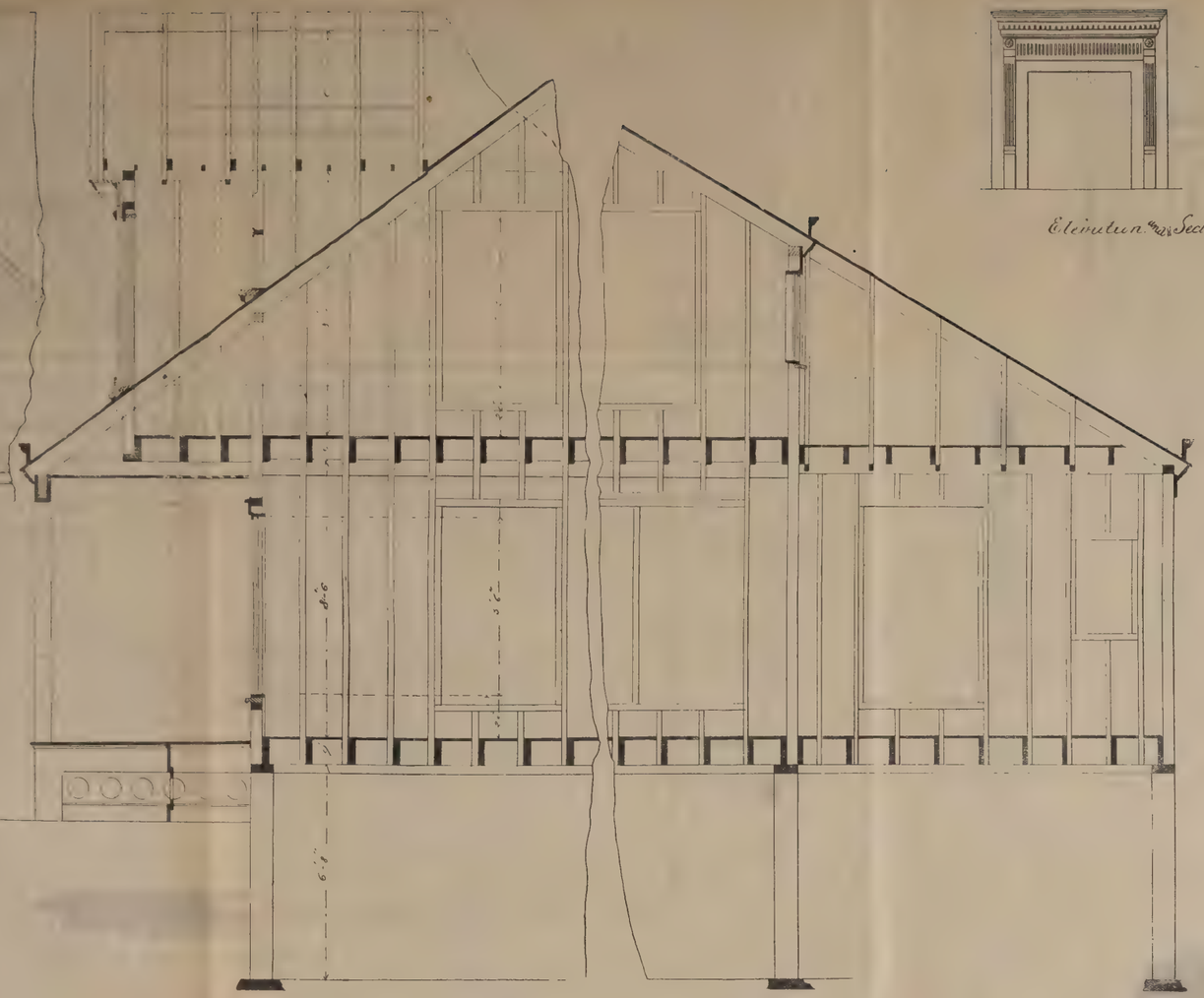
To Ornament a Vase.—Directions are given for making a pretty and artistic vase from an ordinary jar or bottle as follows: Dip a string in spirits of turpentine and tie it around the bottle which has been selected for the purpose, below the neck. Set fire to the string, and it will break the glass off smoothly. Then cover the bottle with glue, and roll it in oatmeal and varnish when it is thoroughly dry.

A DOUBLE HOUSE FOR $2500.00



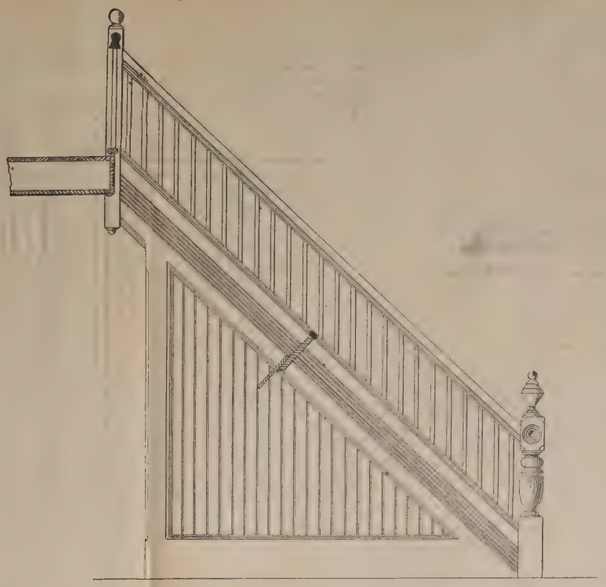
Front Elevation.

Section

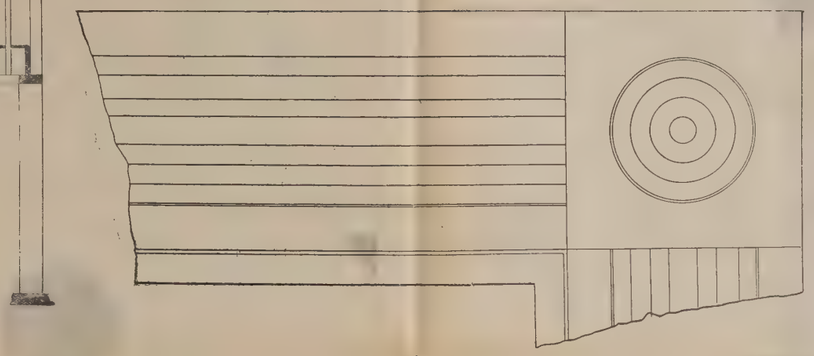


Section through House showing Heights of Stories, Windows &c

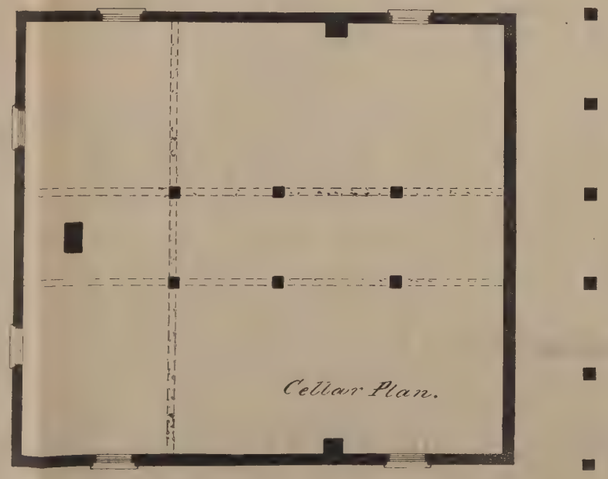
Elevation & Section of Mantel.



Elevation of Staircase



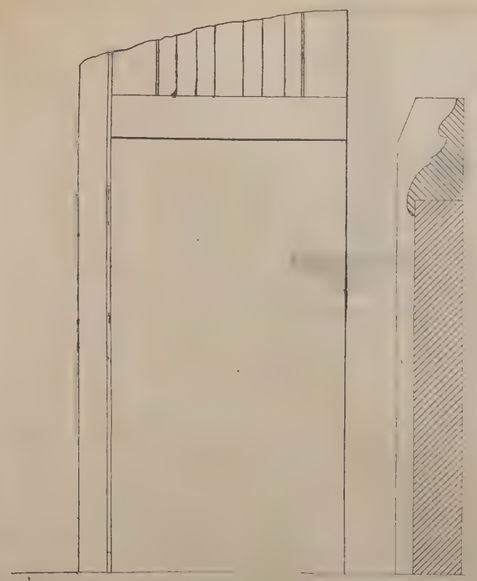
Rear Elevation



Cellar Plan.

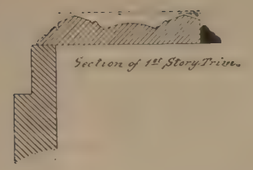
A Double House for $2,500.

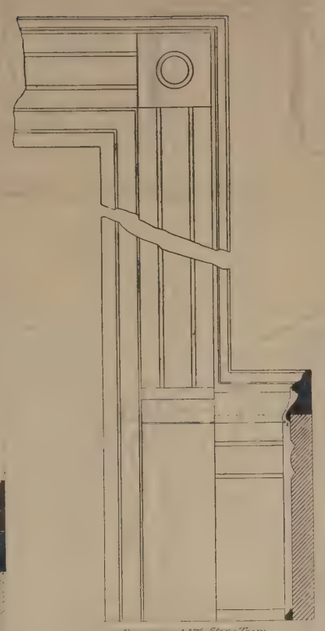
1st Story Trim.

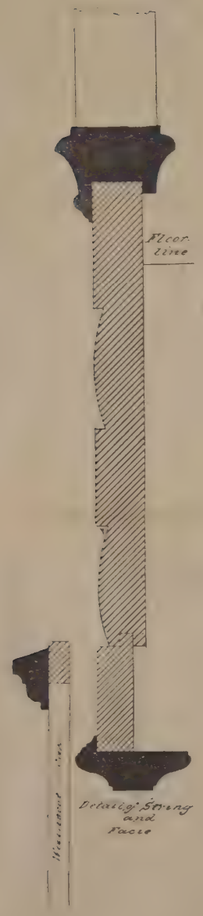


Base

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for May, 1888.

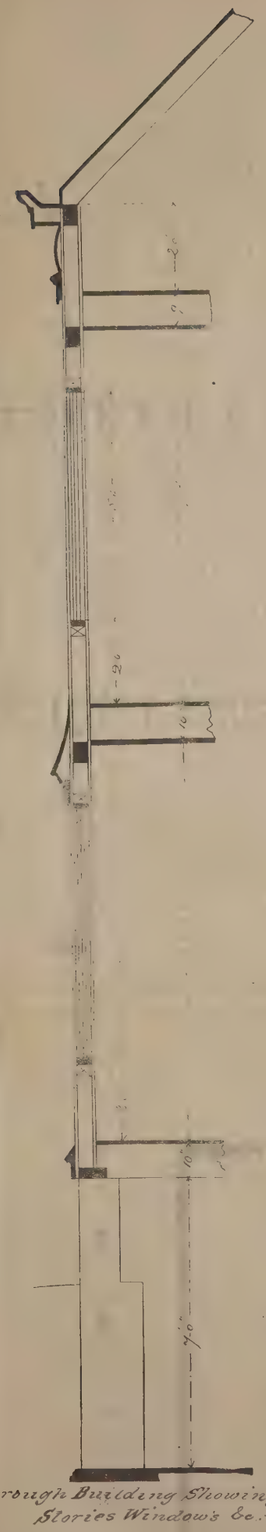


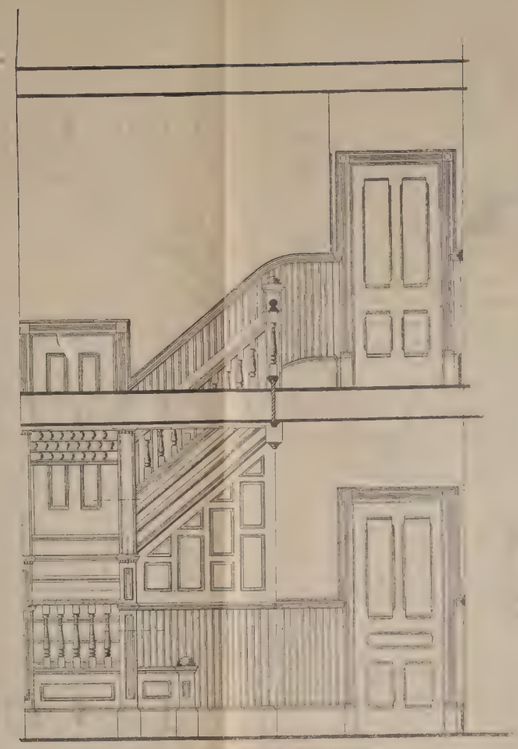




Rail.

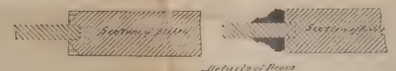
A Cottage of Moderate Cost.

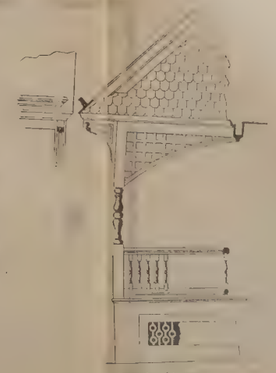


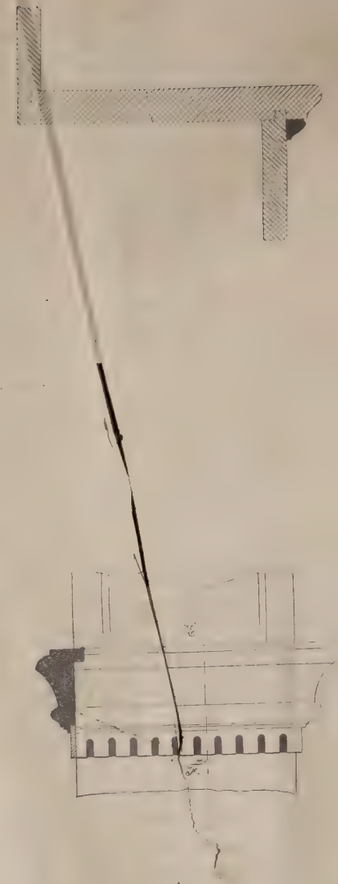


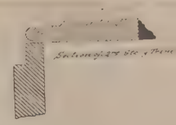
Section of Hall and Parlor

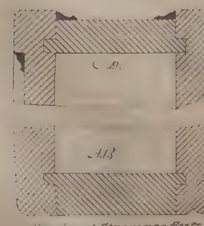
Section of Wainscot











Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for May, 1888.

A Cottage of Moderate Cost.

A DWELLING FOR $2,500.

Large chamber on first floor. Hall, parlor, dining room, and kitchen good size. Open fireplaces in parlor, dining room, and chambers. Two nice chambers in second story. Cellar under whole house. Front, 27'. Side, 50'. Height of cellar, 7'. First story, 9' 6". Second story, 9'. Foundation of stone. First and second stories, clapboards. Roof and gables, shingles. Cost, without mantels or furnace, $2,500.

A DWELLING FOR $2,500.

TWO MODERN DWELLINGS.

The two designs shown illustrate modern ideas in Massachusetts. The main entrance to the larger house is through a spacious reception hall, with an open fireplace, and an alcove to the front, divided from the main staircase hall by an arched screen. The side entrance opens through a vestibule under the stair landing, into the staircase hall, from which opens a lavatory at the left as you enter, and the back stairway at the right. Ascending the front stairway to the broad landing, you may seat yourself and rest if you are inclined to do so, as there is ample room for several pieces of furniture, or you may step out upon the balcony at the right. Ascending further to the second story, a spacious, airy hall opens into five large chambers, provided with large closets, dressing rooms, lavatories, etc. The house is calculated for a family of means, who are not above the enjoyment of everyday home comforts.

The smaller design is likely to become very popular with those who only desire a small house, yet one that is very attractive and convenient. The perspective and floor plans show its various features without further description. These designs, by Frank L. Smith, architect, of Boston, Mass., are from his recent publication entitled "Homes of To-Day," advertised on another page.

AN $8,000 HOUSE.

FIRST FLOOR PLAN.

SECOND FLOOR PLAN.

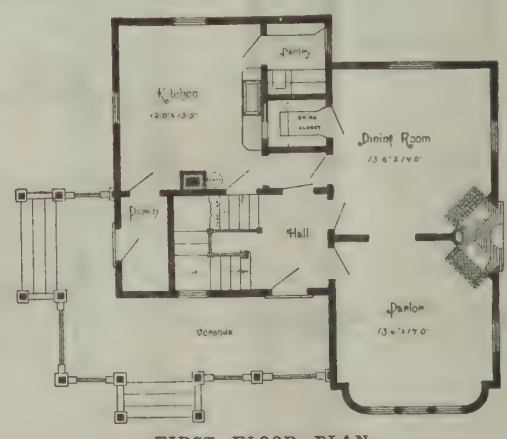
deafening floors. This suggestion, which is due to General Loyre, proposes, instead of loading the floors with a sheet of plastering, to fill in the space between the floor boarding and the plastering of the room below with shavings which are first to be rendered incombustible by dipping them in a tub of rather thick whitewash. It is well known that soft substances inclosing air spaces form the most efficient deafening, and shavings treated in this way are so incombustible as to add considerably to the fire-resisting quality of the building in which they are used. In cases where it is desirable to disinfect the space between floor and ceiling, the shavings may be saturated with chloride of zinc, or zinc chloride may be added to the lime wash.

Filling for Floors.

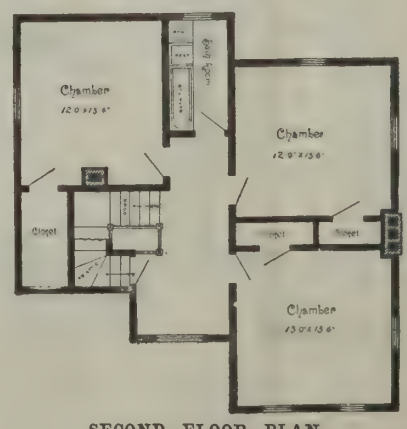
Le Genie Civil quotes from a military journal a rather valuable suggestion for

IT is proposed to preserve fish alive by placing them in vessels partly filled with water and hermetically sealed. It is said that fish so confined have been found alive after three weeks, without either air or water having been changed, while fish in an open jar died in forty-eight hours. If the air in the vessel is compressed, the life of the fish is still further prolonged.

A $2,800 HOUSE.



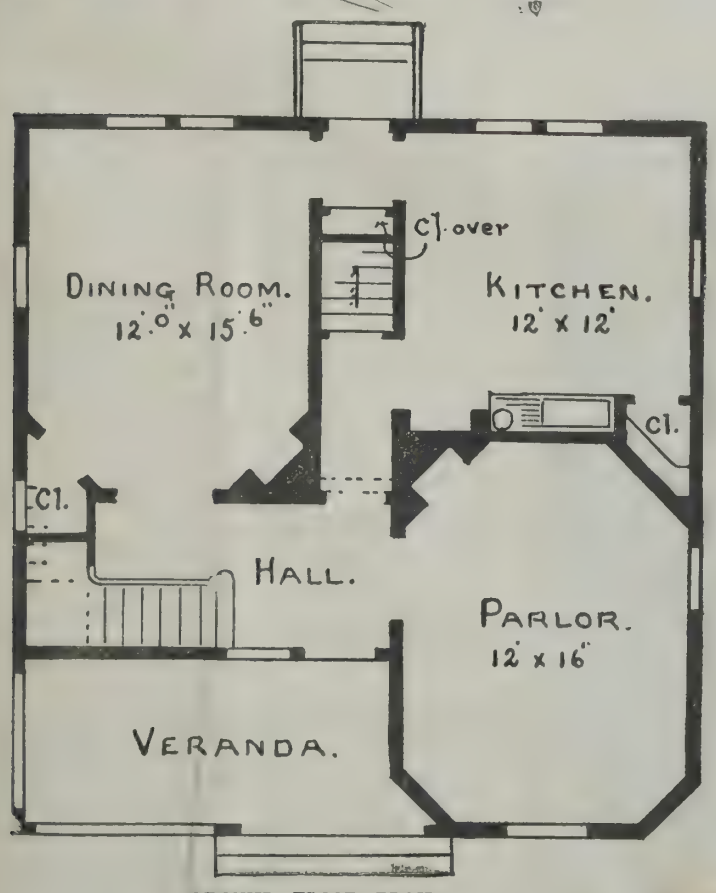
FIRST FLOOR PLAN.



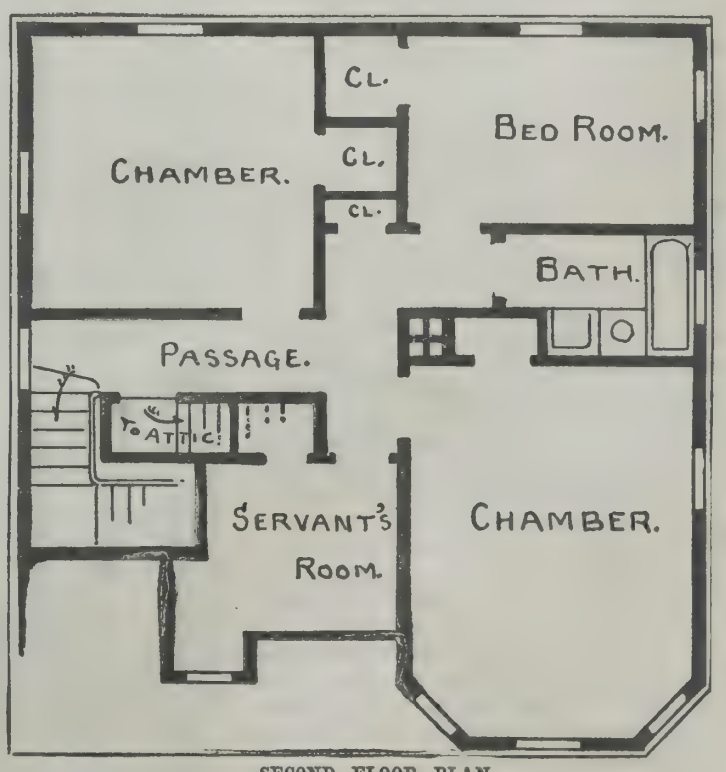
SECOND FLOOR PLAN.

A $2,200 HOUSE.

The rooms are of good size. Parlor and dining room have open fireplaces. Three good bed rooms, servants' room, and bath room on second floor. Cellar under the whole house. Front, 28′ wide. Side, 29′. Height of cellar, 7′. First story, 9′. Second story, 8′ 6″. Open garret. Foundation, stone and brick. First story clapboarded. Second story and roof shingled. Cost, without furnace or mantels, about $2,200.



GROUND FLOOR PLAN.



SECOND FLOOR PLAN.

A $2,200 HOUSE.

FULL plans, specifications, and details, ready for the builder, of any of the houses illustrated in this publication, may be had on moderate terms at this office. Special plans and specifications for the erection of buildings of all grades are also supplied by us. Munn & Co., architects, 361 Broadway, New York.

Plans for the alteration and enlargement or improvement of building are also supplied.

Wooden Water Pipes.

A particular description of wooden water pipe is just now being largely used by the Water Works Company of Denver, Colorado, for conveying considerable quantities of water to districts regarded as too thinly settled to warrant the expense of iron pipes, which are very costly in this part of the States. The advantages of the wooden pipe system are low first cost, rapid construction, facility in transportation, sufficient strength, and reasonable durability. The pipe is, in fact, a long barrel composed of staves of varying length, hooped together by round iron bars. The strength of the construction depends upon these hoops, which are made of ½ inch round rod iron. The ends of each hoop are held in cast iron clips or sockets; one of the ends having a T head, and the other being screwed for tightening by a nut against a boss on the clip. The staves are about 3½ inches wide, and vary in thickness from 1½ to 1¾ inches, depending upon the pressure to be withstood. The hoops are spaced, according to the size of the pipe and the pressure, from 3 to 7 inches apart. Inasmuch as the bursting is resisted wholly by these bands, their spacing for any head is readily calculated. The pipes are made in fair size, from 24 to 48 inches diameter, and are subject to pressure varying from 50 to 120 feet head of water. At local prices, where wood costs 5 cents per cubic foot, and common labor is worth $1.75 per diem, the cost of this pipe is only about one quarter that of cast iron of the same size. Any kind of wood will do for the staves, provided that it is fairly straight grained and free from knots.

THE assessed valuation of real estate in New York City for 1888 is $1,306,310,133, an increase over 1887 of about $52,000,000.

Ready Mixed Paints.

It goes without saying that a paint that will permanently retain its original color, and that will, for an indefinite period, resist the effects of the atmosphere, not only maintains the good appearance of the work, but acts as a perfect preservative of the surface to which it is applied. The durability of a paint is controlled directly by the vehicle or liquid carrying the pigment. It naturally follows that we very seldom find a mixture of a durable vehicle with an inferior pigment, as the latter, by losing its color in a short time, would serve to condemn the paint. The same remark applies to the combination of a superior pigment with a poor vehicle. It may therefore be considered a safe and general rule to avoid those paints which "wash off," and also those which fade, as all of the ingredients in both cases are certainly inferior. The contrary is also true. A paint that will either hold its color or remain where placed for a long time must be composed of the best materials, as it would be against the interests of the manufacturer to give his paint one good quality and not the other.

It requires great skill and long experience even for the manufacturer to tell by examination whether a given paint with which he is not familiar is first-class in every respect, and ninety-nine out of every hundred consumers are compelled to rely solely upon the reputation and standing of the firms they buy from. There is no quick way of practically ascertaining the wearing qualities of a paint. They cannot subject a sample to an exposure to the weather for four or five years, and yet there is no simple or shorter method of finding what they want. A paint recommended because of only one excellent point should be viewed with suspicion. For example, a paint for which only a good body is claimed, or in which only the colors are warranted fast, should be avoided.

We have heretofore called attention to the excellent quality of the ready mixed paints prepared by the well known house of Charles M. Childs & Co., of 225 Pearl Street, New York, who have been in business for nearly forty years.

Messrs. Childs & Co. have more than doubled the capacity of their works, which are located at 41 to 53 Summit Street, Brooklyn, within the last two years. They employ now about one hundred hands, and they have a capacity of 5,000 tons of manufactured goods annually. Owing to the fact that all of the chemical colors they use are made at their factory, they are enabled to quote bottom prices to the consumer, as there are no middlemen to deal with.

They will, if they receive an idea of the colors wanted, furnish such shades as will be sure to be pleasing to the eye and will agree with the conceptions of the owners or builders. When necessary, they will endeavor to fill orders given descriptively of any colors desired, and will undertake to match precisely any sample that may be sent them. It is very difficult to select colors that will blend well, so as to produce pleasing effects. This well known fact has been recognized by Messrs. Childs & Co., who have adopted an effective method for presenting their pure ready mixed paints to builders and householders who may not have the facilities for selection found in the larger places. Their specimen cards display the best style of colors arranged in combinations of three each, showing the body, trimming, and blinds. The specimen card, which they send free to any who request it, contains twenty-seven colors, forming nine combinations, the upper color of which is the body, next the trimming, and the bottom the blinds. By means of this card the different colors can be studied to the best advantage, and an accurate estimate formed as to the effect produced when applied.

This method of presenting colors will not only be appreciated by those who are "color blind," but will be also welcomed by the builder and architect.

We would advise all who contemplate painting this spring to send for one of these cards, even if only to have specimens of the shades that will be widely used. Messrs. Childs & Co. will be pleased to give any additional information desired, and as in dealing with them there are no middlemen between the manufacturer and consumer, it would be well to ascertain their prices before purchasing.

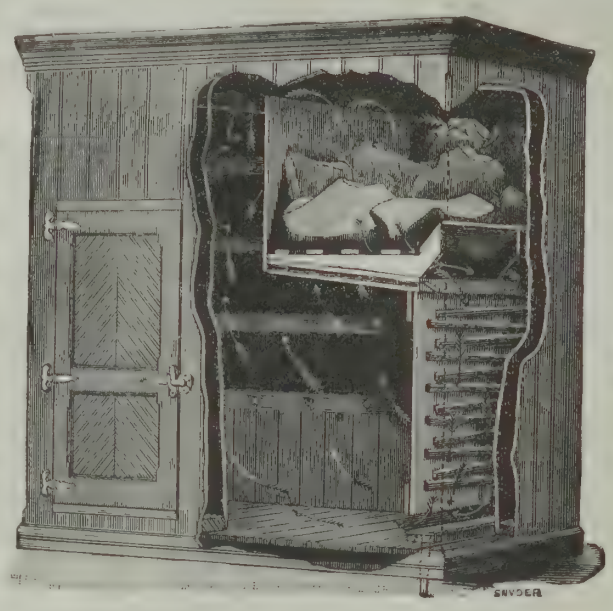
H. W. Johns Manufacturing Company.

This long established manufacturing concern, having warerooms in several of our most prominent cities, the principal one being at 87 Maiden Lane, New York, is still engaged in the production on a large scale of boiler and steam pipe coverings, steam packing, building felt, and a great variety of other articles of which asbestos forms the base of the product.

One of the first articles which brought asbestos into prominence was H. W. Johns fireproof roofing, which he commenced to manufacture some thirty years ago. Encouraged by the success in his roofing, he extended the use of asbestos to the manufacture of a variety of articles other than those mentioned above, the latest of which is a liquid paint, for which he claims as great merit as for his roofing and the other articles of his manufacture.

THE RIDGWAY REFRIGERATOR SYSTEM.

A refrigerator built on the plan of keeping the air confined, on the closing of the refrigerator apartment, pure and dry is illustrated herewith. The ice box is



THE RIDGWAY REFRIGERATOR SYSTEM.

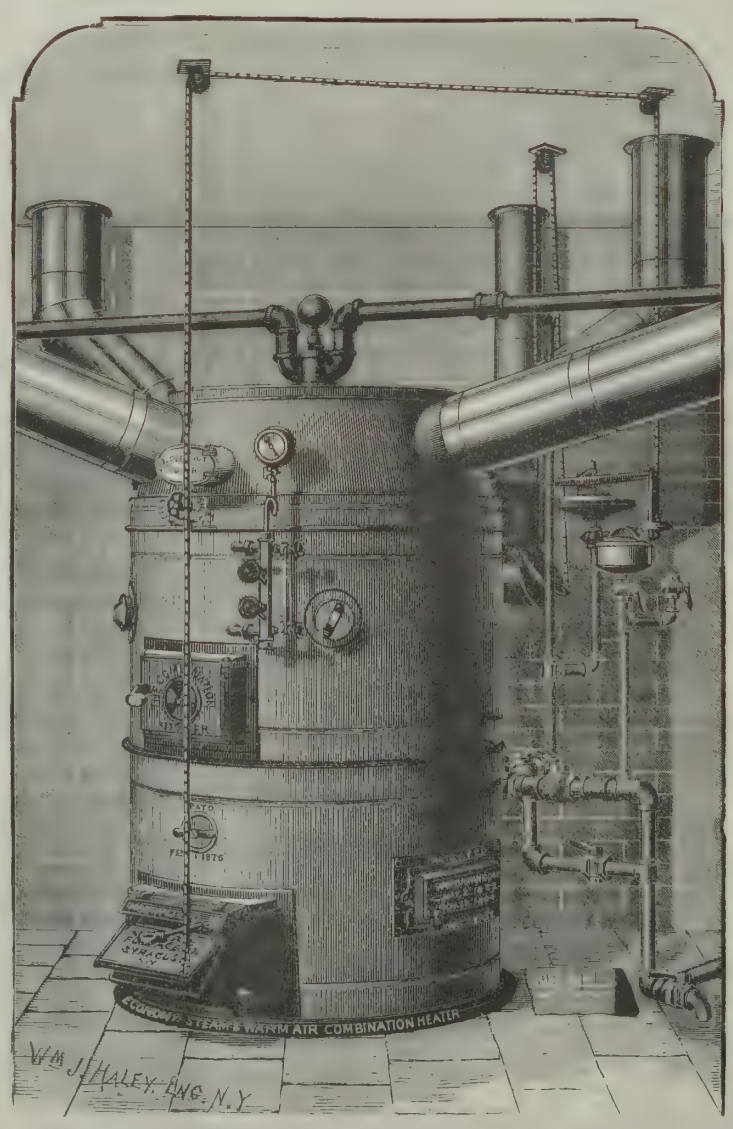
located near the top, and discharges its drip water through a series of V-shaped metallic troughs, through which it circulates forward and backward, cooling the troughs accordingly, until discharged through a trap at the bottom. The air, becoming cooled in contact with the ice and the metallic troughs, falls and distributes itself through the lower portion of the storage compartment, whence it rises again, the air circulation being shown by the arrows. The moisture of the air, carrying with it nearly all the impurities, is condensed upon the cold metallic surface of the troughs, and is carried off with the drip water. The putrefactive changes in food, due to dust-like germs floating in the air, are thus absorbed and carried off with the condensed moisture. This system of refrigeration is very economical of ice, and is extensively and most successfully used in residences, hotels, restaurants, creameries, fruit houses, etc. Refrigerator cars, cold storage buildings, ice houses, and portable refrigerators are built according to this system by the Ridgway Refrigerator Manufacturing Company, Limited, of Philadelphia, Pa.

The Prentice Patent Metallic Hip Shingle.

The attention of architects and builders is invited to this recently patented shingle, which is said to excel in durability, economy, and finish, taking the place of boards or strips, and making wind, water, and snow tight joints, with no nails exposed. This shingle is light and ornamental, and is also applicable to old roofs, preventing the shingling from curling or getting loose. Sole manufacturers, Metallic Hip Shingle Co., Toledo, Ohio.

A SANITARY HEATING APPARATUS.

Among the various systems and methods employed in the construction of heating apparatus with which the public is familiar, there are two distinct methods of producing heat which have become the most general mediums for that purpose, and they are, namely, steam and warm air, and while they have been generally considered as successful agencies, there are certain conditions that render either of these methods alone impracticable in effecting a condition of perfect sanitary heating. There are certain buildings, such as churches, schools, residences, etc., the peculiar construction of which makes it impossible to economically warm them with steam alone, and on account of a rambling construction or an unusually unequal exposure, the warm air system cannot be advantageously used. To such buildings, especially, the Economy combination steam and warm air heater, manufactured by the J. F. Pease Furnace Company, of Syracuse, N. Y., is perfectly adapted. The illustration below will convey to the reader the general mechanical construction of this successful apparatus, which utilizes to the greatest possible extent the entire product of combustion in the production of heat. The apparatus employs the low pressure system, and thoroughly warms a building with from one-half to three pounds of steam in connection with the warm air from the furnace proper. In the interior of the heater is suspended a heavy wrought steel tubular boiler (tested to 100 pounds pressure), and the same fire which generates the warm air also produces the steam, insuring a double result. This apparatus, besides being adapted to the class of buildings above alluded to, possesses many peculiar points of excellence which commend it to all householders and property owners. These points, enumerated briefly, are perfect control, automatic regulation, absolute safety, cleanliness, and durability, and, lastly (but first to be considered), economy in the use of fuel. No more coal is burned in this apparatus during the chilly days of spring and fall than is necessary to produce the temperature required, at which time the warm air alone can be generated with a light fire, and not using the steam radiating portion until the colder weather demands it. We have not the space to elongate on the inestimable value of these valuable features combined in this combination heater, but will simply refer all interested readers to the J. F. Pease Furnace Company, who will take pleasure in mailing to any address their complete catalogue, containing full particulars and testimonials from thousands whose experience corroborates the claims the Pease Company make for the superiority of their product.



A SANITARY HEATING APPARATUS.

Messrs. Wilkinson & Banta, of No. 250 Water Street, New York, have been appointed New York agents of the Abram Cox Stove Company, proprietors of the Penn Stove Works, of Philadelphia, and will hereafter have a headquarters and depot for these goods in the New York stove market. They will carry here a full line of the Novelty stoves, ranges, and furnaces, to fill promptly large or small orders, and will be able to fill all repair orders at short notice.

The "Pecora Mortar Stain," manufactured by Messrs. S. Bowen's Sons, of Philadelphia, is being used for coloring the mortar in the new Girard estate stores, now well under way in that city. These stores are to occupy four sides of a solid block, and are being built of iron and Philadelphia pressed brick, with stone trimmings. The use of this stain, therefore, in a work of such solid character, forms of itself a high recommendation.

The Ehret-Warren Manufacturing Company is the style of a corporation succeeding to the business of M. Ehret, Jr. & Co., of St. Louis, Mo., and S. D. Warren & Co., St. Louis and Kansas City, Mo., manufacturers and dealers in all coal tar products, including roofing pitch and felt, sheathing papers, roofing paints, etc.

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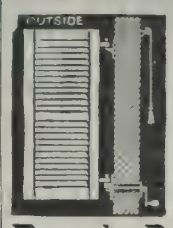

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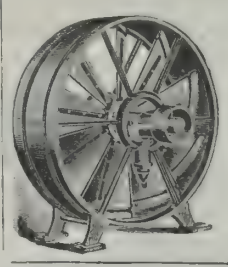

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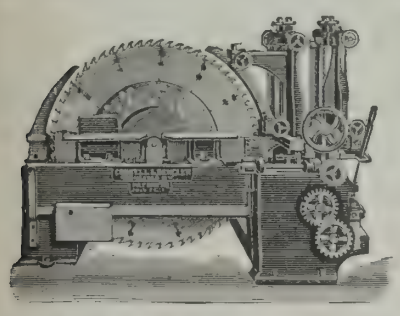

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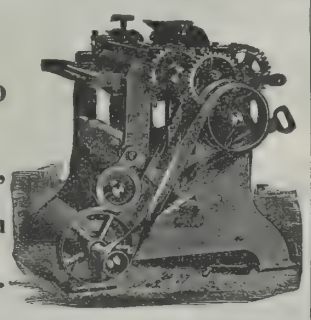

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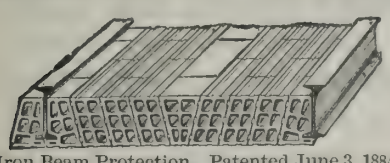

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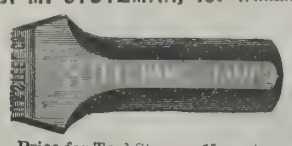

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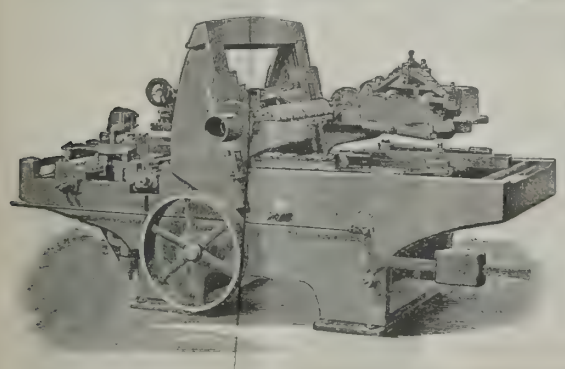

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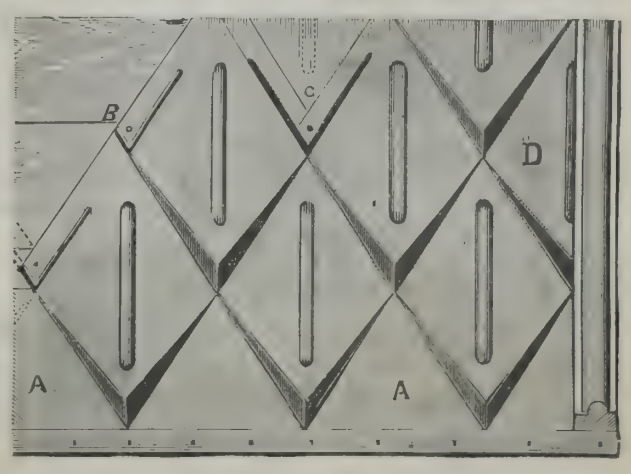
All the above goods are packed a square to the box and delivered f. o. b. cars in Philadelphia.

For particulars, price lists, etc., address

THORN SHINGLE & ORNAMENT CO. **12th & Callowhill Streets, Philadelphia, Pa.**

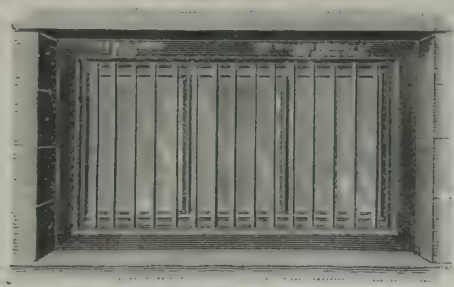


Notes and Queries.

(1) J. D. M., of Baldwinsville, N. J., has built a factory of which the first story is used for a machine shop, the second for pattern making and the attic for storage of seasoned lumber. The building is 20′ × 40′ and the roof has a rise of 12 feet. The roof is tin, laid on hemlock lining boards, and the difficulty to to be overcome is "sweating of the tin." The building is heated by steam, and a coil was put in the attic, and also two 6″ ventilators, but these devices did not remove the difficulty. The effort was in the right direction, for a complete circulation of air in the attic would reduce the condensation to a minimum. A. From the drawing sent, we would infer that no provision was made for the supply of out door air. The ventilators are large enough to do the work properly, provided an opening is made for the ingress of fresh air. The drawing shows a window in the gable. Cut the window down to the floor level of the attic and open the lower sash, not the upper one, about six inches. This should provide a current of air moving through the attic at the rate of about one foot per second. If the plan does not work, the hemlock roof lining may be covered on the under side with waterproof building felt fastened to strips of lath laid across the boarding, care being taken to lap the paper at the joints at least two inches, and laid close as possible. If the hemlock roof sheathing had been carefully covered with building felt and the tin laid upon that, in the first place, no trouble would have been experienced from condensation.

Improved Iron Cellar Window Frame and Sash.

Strong.
Convenient.
Attractive.
Economical.



No Decay.
No Swelling or Shrinking.
No Warping.
No Binding.

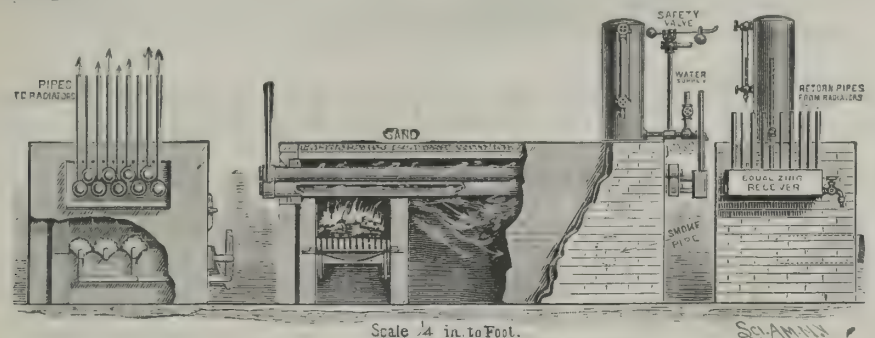
13 SIZES IN STOCK.

Send for Price List.

THE McLAGON FOUNDRY COMPANY, IRON FOUNDERS AND PATTERN MAKERS, NEW HAVEN, CT.

GATES IMPROVED HOT WATER HEATER.

This is the only system of heating which, with cold weather and warm rooms, has smoke pipe only warm. I have never seen steam heater, furnace, or other hot water heater that would do this. Hence, greater economy of fuel over all others; and while this possesses every advantage that others have, this also has the positive circulation to each room due to the independent boiler system. Notice, this is the only system having tank for water supply in cellar, and will, for a month at a time, supply water automatically to each radiator. This works by air pressure. Improved noiseless circulation. Stops the overflow which is liable to occur with open tanks in upper rooms. No overflow to wet ceilings and ruin house. Perfect combustion of fuel, because no water comes around the fire, and more boiler surface exposed to fire than usual to do same work. Boilers for house heating each 3½ in. in diameter, 8 ft. 6 in. long.



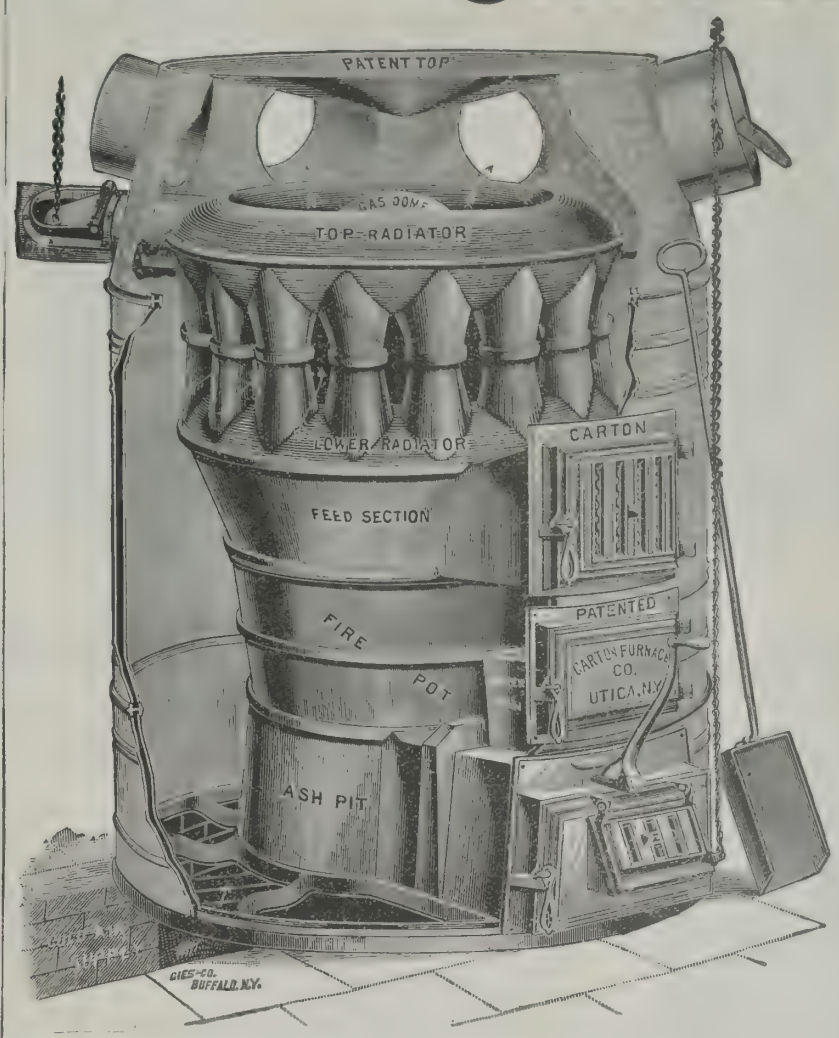
Scale ¼ in. to Foot.

SOME OF PARTIES USING THIS SYSTEM.

Senator Hartwell, Geo. F. Simonds, C. H. Whittemore, A. W. Baker, H. F. Coggshall, E. A. Goodrich, Alonzo P. Goodrich, John M. Carpenter, David E. Rand, Fitchburg, Mass.; Dr. Hartwell, Ayer, Mass.; D. G. Hitchcock, Warren, Mass.; O. L. Cowles, J. U. Johnson, Springfield, Mass.; E. L. Lyman, J. G. Bishop, Holyoke, Mass.; S. P. Gardner, Haverhill, Mass.; Dr. E. E. Denniston, S. D. Drury, Geo. F. Drury, O. C. Bridgman, R. S. Bartlett, Northampton, Mass.; S. F. Snow, J. S. Wilcox, Deep River, Conn.; J. W. Rigdon, Topeka, Kansas; A. N. Stanton, Bridgeport, Conn.; Heslop & Curtis, A. C. Van Gilder, Point Pleasant, W. Va.; Mrs. A. E. Leonard, Westfield, Mass.; C. A. Gridley, So. Hadley, Mass.

For full particulars and price, address **E. N. GATES, Box 1504, Fitchburg, Mass.**

NEW "CARTON"



All Cast Iron. Self Cleaning. Two Radiators and No Bolts used. Immense Radiating Surface. "Happy Thought" Revolving "Duplex Grate."

NO CLINKERS.

Send for our New Catalogue for 1888.

—Sole Owners and Manufacturers,—

CARTON FURNACE CO.

UTICA, N. Y.

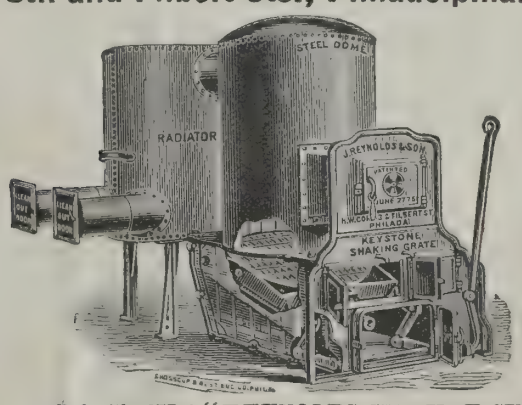
Established 1847. Incorporated 1883.

"The Best is the Cheapest." "A Perfect Furnace at Last."

Keystone Steel Furnaces,
Air Tight Steel Furnaces,

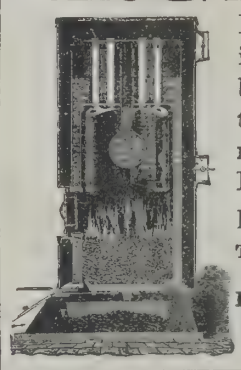
Manufactured by J. REYNOLDS & SON,

13th and Filbert Sts., Philadelphia.



These Furnaces are supplied with **THE "REYNOLDS CLINKER CUTTING GRATE"** with Patent Dumping Attachment, the best **LABOR** and **FUEL SAVING** invention ever applied to **HEATING APPARATUS.** It is perfection. The Grate can be dropped and cleaned off with closed doors, thus preventing all dust. These Furnaces are perfectly **GAS, SMOKE** and **DUST TIGHT.** **SEND FOR CIRCULAR.**

The Globe Steam Heater



Has been thoroughly tried in many private and public buildings and always found to be the best. Very economical, and easily managed. Large surface exposed directly to the fire. Ask for all particulars before you place your order for any other.

THE GLOBE SAFETY DAMPER REGULATOR SHOULD BE USED ON EVERY STEAM HEATER IN USE.

For new Illustrated Price List of Globe Steam Heating Appliances, address

Globe Steam Heater Co., North Wales, Pa.

REFRIGERATORS.

Estimates furnished (under new construction) for

Hotels, Stores and Butchers' Use

ALSO A LINE

FOR RESIDENCES,

BY

FRANK W. LOCKWOOD.

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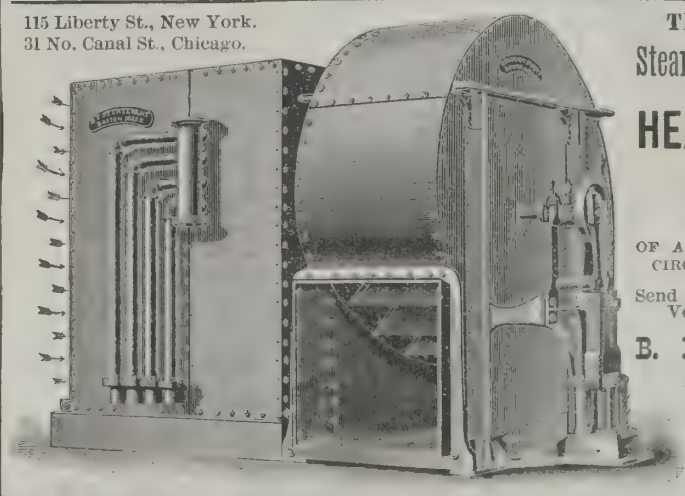
115 Liberty St., New York.
31 No. Canal St., Chicago.



THE STURTEVANT
Steam Hot Blast Apparatus
FOR
HEATING and VENTILATING
BUILDINGS
OF ALL KINDS, BY A FORCED CIRCULATION OF WARM AIR.

Send for Illustrated Treatise on Ventilation and Heating.

B. F. STURTEVANT,
BOSTON, MASS.

BRANCHES:
New York. Chicago.

THE BRIDGEPORT WOOD FINISHING CO

G. M. BREINIG, AGENT. PRINCIPAL OFFICE & MANUFACTORY NEW MILFORD, CONN.
NEW YORK BUSINESS OFFICE, 96-98 MAIDEN LANE. MANUFACTURERS OF
WHEELERS PATENT WOOD FILLER.
BREINIG'S LITHOGEN SILICATE PAINT
LITHOGEN PRIMER, WOOD STAINS
SILEX FLINT AND FELDSPAR.
PAMPHLET GIVING DIRECTIONS FOR FINISHING HARD WOOD FREE TO ANY ADDRESS

ART STAINED GLASS

FOR CHURCHES, DWELLINGS, Etc.
Keystone Stained Glass Works,
271 SOUTH 5th ST., PHILADELPHIA.

Klein's Economist Steel Plate Furnaces

AND

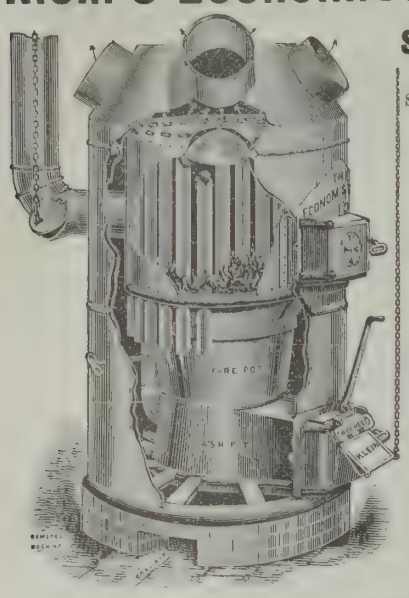
STEEL PLATE ECONOMIST RANGES

Are Superior to all others.

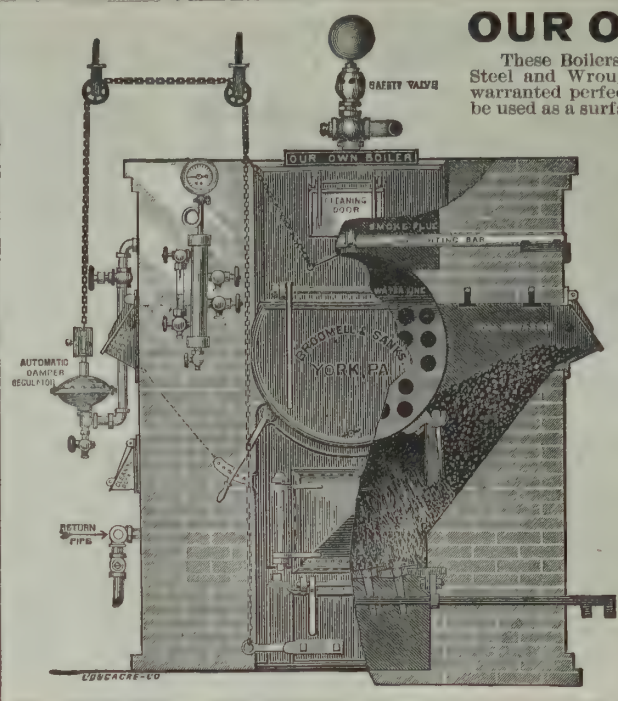
Simplicity, Durability, Economy, are its chief advantages.

TRY THEM, AND YOU WILL HAVE NO OTHERS.

KLEIN FURNACE CO., Rochester, N. Y.



OUR OWN BOILER



These Boilers are made of the best quality of Steel and Wrought Iron Boiler Plate, and are warranted perfectly safe at 100 lb. pressure. Can be used as a surface burner or Magazine Boiler, as desired. Magazines will hold sufficient coal to keep up steam for 48 hours.

Particular attention is called to the arrangement of check doors in the magazines by which THE FLOW OF COAL CAN BE REGULATED to a nicety, or can be prevented entirely.

It is impossible to use any magazine boiler successfully except by the aid of these check doors, of which we are the exclusive owners.

☞We make an exclusive business of Steam and Hot Water Heating, and the manufacture of

"Our Own" Boilers

—AND—

"Our Own" Radiators.

We guarantee satisfaction in every respect in Private Houses, Churches, Schools, Manufacturing Establishments, etc.

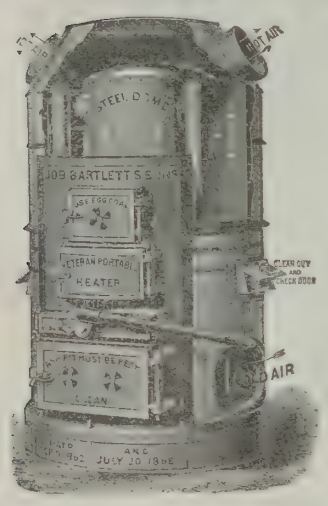
ADDRESS:

Broomell & Sanks,
YORK,
PA.

Bartlett's Wrought-Iron, Brick-Lined Portable Furnace.

THE VETERAN,

For fifty years has proven the Veteran's Power, Durability, Efficiency, and Reliability.



NO DUST,
NO GAS,
NO SMOKE,
NO DAMPERS.

No Overheated Cast-iron Surfaces.

Fire Clay Lined Fire Chambers.

The Veteran is made of Heavy Boiler Plate Iron. A Shaking and Dumping Grate is attached, which will give you great satisfaction in its control and management. Pure warm air in great abundance. Every furnace is warranted to give perfect satisfaction.

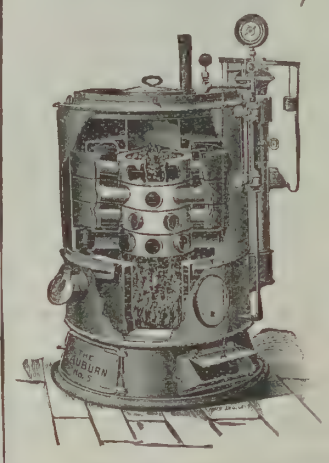
ESTABLISHED 1847.

Job Bartlett's Sons, 10th & Filbert Sts., Phila.

ESTIMATES AND ADVICE FREE.

"THE AUBURN" STEAM HEATING BOILERS,

Automatic, Self-Feeding, Portable.



Requires attention but once in from twelve to twenty-four hours. Fuel magazine surrounded by water. Self-locking shaking grate. Waste of coal *impossible. No dust. No gas.*

The Woodcock Patent Shaking Grate,
For Boiler Furnaces of all Descriptions

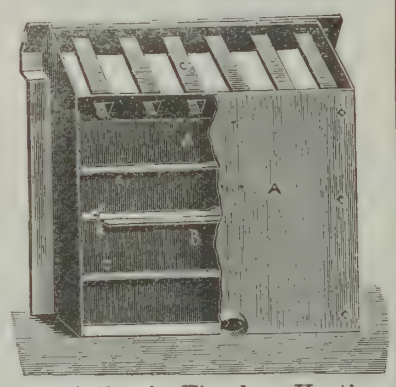
Saves its cost in a year, supplanting all other shaking grates. No waste of coal. No burnt or broken grates. Self-locking, and as nearly automatic as a grate can be made.

Send for Illustrated Catalogue.

Woodcock & Co., Auburn, N. Y.

The OMEGA FIREPLACE FURNACE

20 page illustrated catalogue, containing full information and prices, sent to any address.



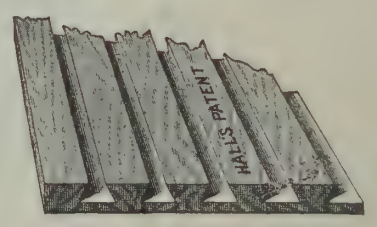
A Double Heater and Perfect Ventilator. Gives the combined heat of both a Furnace and Fireplace, with Perfect Ventilation. Equalizes the heat in every part of the room. Burns equally well Hard or Soft Coal, Wood or Coke. Address

A Revolution in Fireplace Heating.

OMEGA STOVE AND GRATE CO.,
89 Euclid Ave., Cleveland, Ohio.

HOW TO BUILD A PERFECT HOME WITH VERY LITTLE COST.

USE COMBINED SHEATHING LATH.



Hall's Patent.

It makes a cheaper, warmer and stronger house than brick or stone. It is a dry and therefore a healthy house. The plaster will not crack. Architects and Builders specify it all over the country.

ADDRESS

The Byrkit-Hall Sheathing Lath Co.,
226-228 LA SALLE STREET, Room 28, CHICAGO, ILL.

For Eastern and New England States, address

I. C. JENKINS, OSWEGO, N. Y.

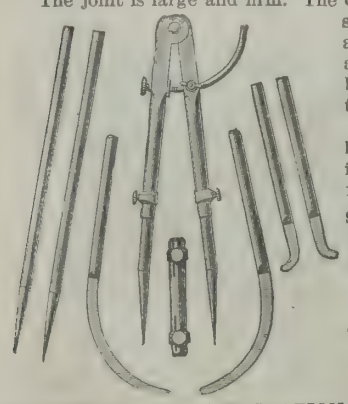
New Combination Dividers.

Forming Dividers with short and long extension points (pencil may be used in connection with either), Outside Calipers, Inside Calipers and Hermaphrodite Calipers.

The head and socket legs of this tool are made from drawn (not cast) bronze metal, and are hard, tough, strong, and finely finished.

The joint is large and firm. The quadrant is round and fastened by an improved method. The steel points are tempered by a process which leaves them hard and tough. On the threaded end of the quadrant, between the adjustable legs, is a knurled nut, against the inside of which a helical spring acts. After the points are adjusted the nut may be turned back against the leg, LOCKING IT FIRMLY.

A common pencil fits either socketed leg, while an auxiliary holder is also furnished to fit reversed end of either point. This is one of the most useful combinations of the kind, as well as the BEST MADE tool ever produced.



STARRETT'S NEW COMBINATION DIVIDERS.

Send Stamp for Illustrated Price List of Fine Tools for Mechanics.

L. S. STARRETT,
MANUFACTURER OF
Combination Squares, Caliper Squares, Bevel Protractors, Thread Gauges, Steel Rules, Surface Gauges, Scratch Gauges, &c., &c.

Full Line of Calipers and Dividers, best on the market.

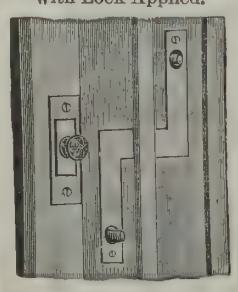
ATHOL, MASS.

Timby's Burglar-Proof Sash Lock and Ventilator.

Patented March 29, 1887.

Manufactured from the Best Malleable Iron, Steel, Brass and Bronze Metal.

Fig. 1.—Section of Frame with Lock Applied.



Thumb Nut moved upward, releasing upper sash.

Is very simple in construction, strong and durable, absolutely **Burglar-Proof**, and a perfect Ventilator; automatic in action, easily applied to any window, as it adjusts itself to varying thicknesses of sash or inside stops.

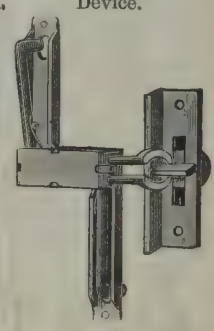
Only One Lock is Required for a Window,

as it controls both sash perfectly, bolting either or both securely in any position desired, thereby affording means for perfect ventilation, and at the same time absolute security against burglars and sneak thieves. It is easily operated, ornamental in appearance, and does not interfere with applying weather strips or inside blinds. It is just as important that each and every window should be provided with a good, substantial lock as that the front door should be. *Buy the Timby Burglar-Proof, and take no other.* The convenience and absolute security afforded will be ample reward. Full directions and pattern for setting accompany each lock.

For Price-List and further information, apply to

JENKINS & TIMBY,
OSWEGO, N. Y.

Fig. 2.—Back View of Lock and Operating Device.



Thumb Nut moved upward and bolt thrown back, same as in Fig. 1.

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CLASSIFIED ADVERTISEMENTS.—Continued from page xi.

The Thomson-Houston Electric Co.

—MANUFACTURE—

THE ONLY PERFECT AUTOMATIC SYSTEM OF

ARC AND INCANDESCENT LIGHTING

In the World.

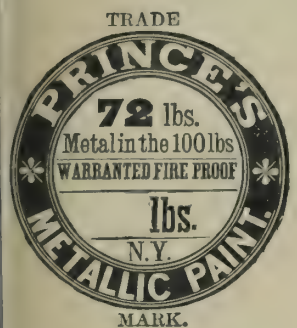
☞ New illustrated pamphlet will be furnished on application.

THE THOMSON-HOUSTON ELECTRIC COMPANY,

Principal Offices: 178 Devonshire St., BOSTON.

Western Offices: Pullman Building, CHICAGO.

TRADE



MARK.

PRINCE'S METALLIC PAINT

An Indestructible Coating for

Iron, Tin and Wood.

Will cover twice the surface at less than half the cost of lead.

But one color made, "Brown." Send for circular, to the sole manufacturers,

PRINCE MANUFACTURING CO.,

71 Maiden Lane, New York.

FLOORS

End-Wood a Specialty.
Parquetry, Wood Carpet.

Fine Hardwood Floors of every approved kind.

END-WOOD MOSAIC is the most perfect and durable floor covering ever made of wood.

CATALOGUE FREE. SAMPLE BY MAIL, FOUR CENTS. MANUFACTURED BY

WOOD-MOSAIC CO.,

Office and Works,
318 SCIO ST., ROCHESTER, N. Y.

Salesroom,
321 FIFTH AVE., NEW YORK CITY.

Novelty Furnaces and Ranges

Novelty Hot Air Furnace.

BEST IN USE.

Tens of thousands in use.

Thirteen years of service.

Universally satisfactory.

Original and only Steel Plate Three Drum Construction.

EIGHTEEN SIZES & STYLES.

SOMETHING NEW:

Model Novelty Range.

Economy in Space, Fuel, and Labor.

No Brick Jambs or Lintel or Boiler Stand.

Horizontal Hot Water Boiler on Top of Range.

HOT AIR ATTACHMENT.

MANY OTHER FEATURES.

Architects, Builders, and Owners should see and call for the above Specialties for Dwellings or Apartment Houses.

ABRAM COX STOVE CO.,
PHILADELPHIA and CHICAGO,

EXPERTS AND SPECIALISTS IN HOT AIR AND RANGE SUPPLIES.

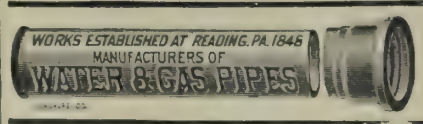
NEW YORK AGENCY:
WILKINSON & BANTA,
250 WATER STREET.

ART STAINED GLASS

For Churches & Dwellings

Antique and Mosaic Work.
Designs and Estimates on application.

William Reith,
134 N. 7th St., Philadelphia, Pa.



Cast Iron Pipe for Structural Work, Columns, etc.
Flange Pipe and Specials.
STOP VALVES, FIRE HYDRANTS, LAMP POSTS.
MELLERT FOUNDRY & MACHINE CO., Limited,
READING, PA.

Art * Metal Work

The JOSEPH NEUMANN CO., Limited,

BRASS LAMPS FOR CHURCHES.
BRASS WORK FOR CHURCH ALTARS.
BRONZE GRILLES FOR DOORS.
WINDOW RAILINGS.
ORNAMENTAL LANTERNS.
BRASS RAILINGS FOR BANKS.
METAL SIGNS.

N. W. Cor. Eleventh & Race Sts.,
PHILADELPHIA, PA.

STAINED GLASS

MEMORIAL, CHURCH, AND DOMESTIC WORK.

C. H. POSTEL & CO.,

Branch Office, 527 Arch Street. 1314 RIDGE AVE., PHILADELPHIA.

BUFFALO STAINED GLASS WORKS

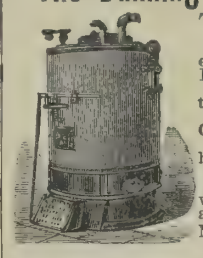
ESTABLISHED IN 1845.

Manufacturer of Ecclesiastic and Domestic

ART STAINED GLASS,

F. J. RIESTER, Prop'r, Buffalo, N. Y.

The Dunning Patent Wrought Iron Boiler. (Over 13,500 in use.)



THE Dunning Boiler, Self-Feeding, is the best for Low Pressure Steam Heating, and insures a warm house night and day. Free from Carbonic Acid Gas and Smoke. Made in eleven sizes, suitable to heat the **Smallest Cottage** to the **Largest Business Block**, in five different styles:

As a Magazine Boiler, which requires attention but once in twenty-four hours.

As a Surface Burning Boiler, which will burn Hard or Soft Coal, Wood, Coke or Gas.

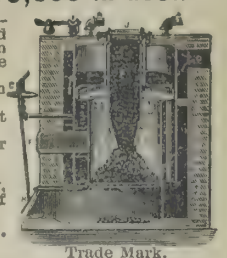
As a Hot Water Boiler, for Green House and hot water heating.

As a Portable Boiler, to be set without brickwork.

Also in **Two Sections**, to pass through any door or window, where whole one cannot enter. Steam Engines and Boilers of all kinds and machinery generally. Manufactured at the

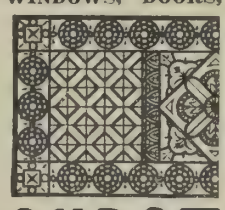
New York Central Iron Works, Geneva, N. Y., U.S.A.

LOCK BOX 40. *Send for New Illustrated Catalogue.*



Trade Mark.

Beautiful & Lasting for ORNAMENTING WINDOWS, DOORS, TRANSOMS, &c.



Stained Glass SUBSTITUTE

AT SMALL COST. Send for Illustrated Catalogue and Prices. **Samples by mail 25 cents.**

W. C. YOUNG SOLE AGENT, 733 ARCH ST. PHILADELPHIA, PA.

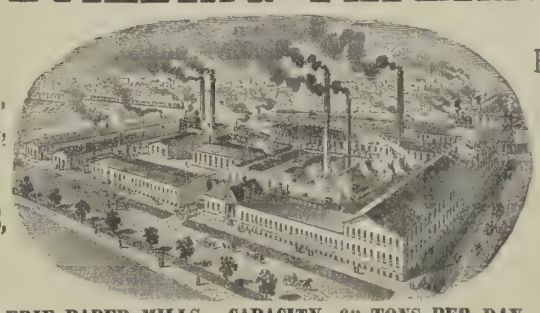
AGENTS WANTED EVERYWHERE.

KEYSTONE PREPARED ROOFING

BEST QUALITY. EASILY APPLIED.

BUILDING PAPERS.

ROSIN SIZED and WATERPROOF SHEATHINGS, DEADENING FELTS, PLAIN and CORRUGATED CARPET LININGS, ASBESTOS SHEATHINGS, Etc.



2 and 3 PLY PREPARED ROOFING, TARRED ROOFING FELTS, ROOFING MATERIALS, Etc., Etc. Send for Samples and Prices.

ERIE PAPER MILLS. CAPACITY, 60 TONS PER DAY.

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H. F. WATSON, 84 & 86 Washington St., Chicago, Ill.

NASHVILLE ROOFING & PAVING CO., Nashville, Tenn.

LIBBY & WILLIAMS PAPER CO., St. Louis, Mo.

Warren-Ehret Co.,

—MANUFACTURERS OF—

ROOFING

OF ALL KINDS.

BUILDING & SHEATHING PAPERS,

Also all kinds of Concrete Cement Work Pavements, Cellar and Stable Floors, etc.
Broken Slag for Roadways, Concreting, Railroad Ballast, etc.

OFFICE, 428 MARKET ST., PHILADELPHIA.

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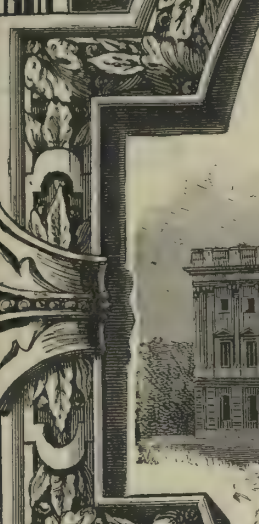

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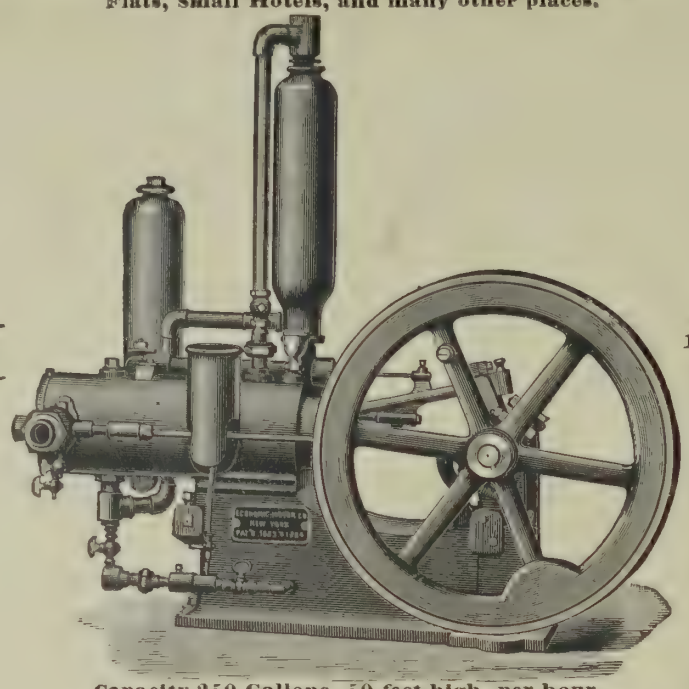

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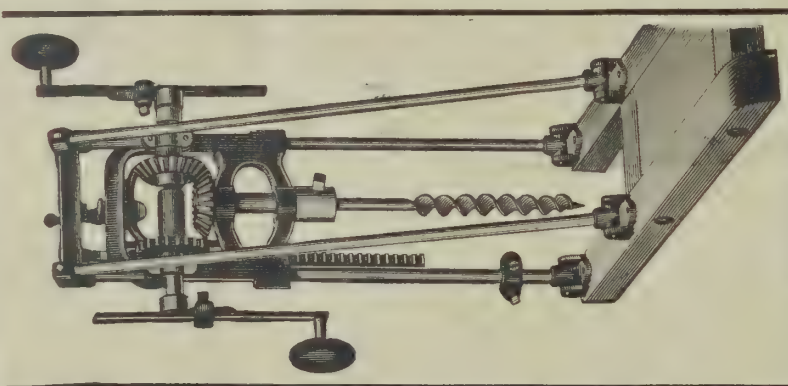

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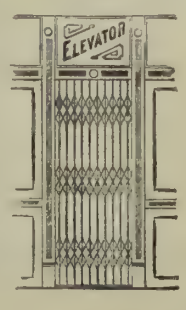

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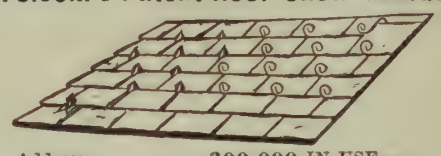

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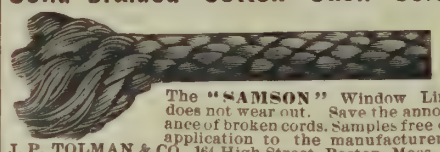

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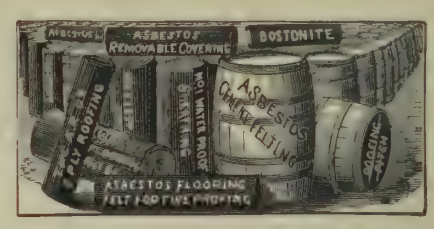

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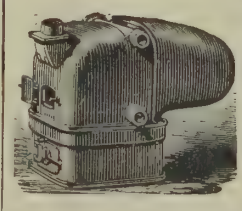

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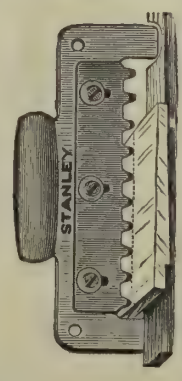

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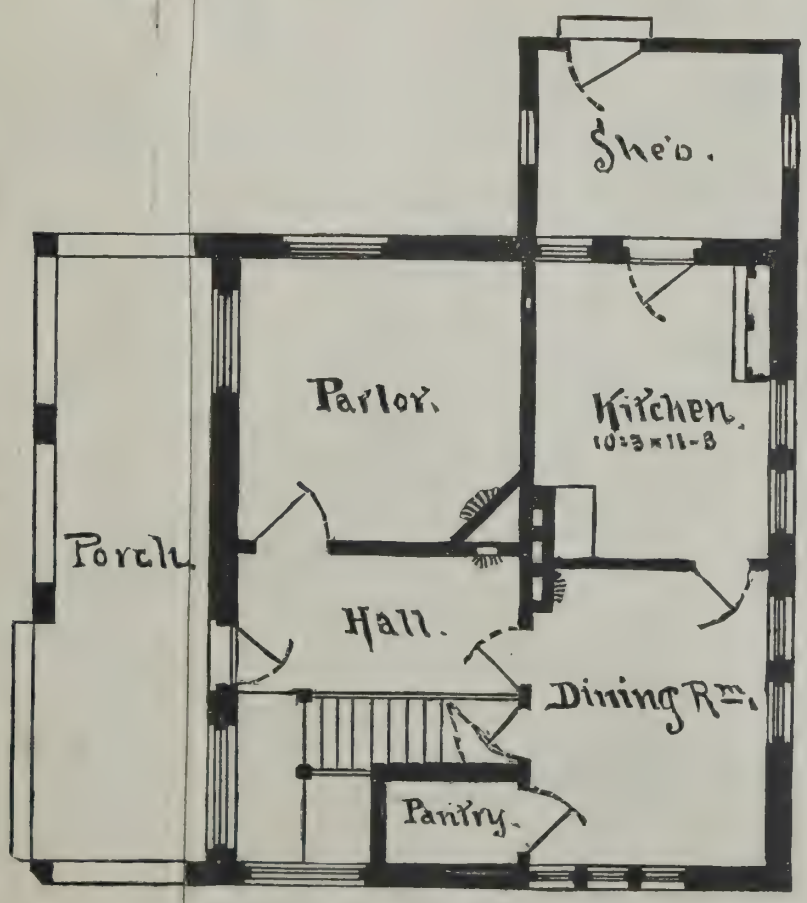
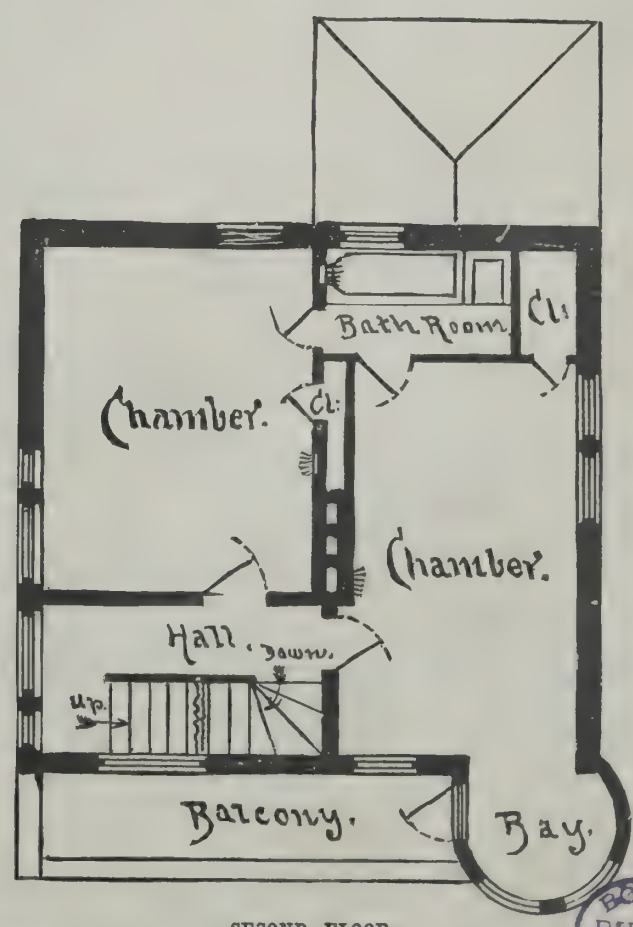


FIRST FLOOR.



SECOND FLOOR.

A COTTAGE OF FIELD STONE AND WOOD.

[For description see page 110.]

Scientific American.

ESTABLISHED 1845.

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CONTENTS

Of the June number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

A RESIDENCE AT TUXEDO PARK.

One of our colored plates this month illustrates a beautiful dwelling erected for Mr. Lorillard at Tuxedo Park, N. J., from designs by James Brown Lord, architect, of this city. Plans and details are given on our accompanying supplementary thin sheet. This house is an effective example of recent domestic architecture, and reflects credit upon the genius and skill of the designer. It is built of stone up to top of first story; above that Michigan pine, shingled, the roof of cedar. The upper floor is finished in whitewood, stained. The hall in first story is finished in oak, library mahogany, drawing room oak. The music room is furnished in white and gold, hung with tapestries. Ceiling is elaborately ornamented in modeled plaster in relief. The interior finishings are superb.

TWO DWELLINGS OF MODERATE COST.

We give a colored plate showing two houses suitable for city or country lots. They are somewhat similar in external appearance, but the interiors are differently arranged. One of them has a high stoop, so as to utilize the under part of the house as basement. The other has the ordinary cellar. Either elevation could be applied to the floor plans, with slight changes.

In the house shown on the right, there are open fireplaces in dining room and the front and back parlors. Convenient and easy staircase. The front measures 18′; side, 36′ 6″. The floor plans show sizes of rooms. Height of basement 8′, first story 10′, second story 9′ 6″. The foundation is of brick. First and second story clapboarded, except part of front, which is shingled. Roof shingled. Cost complete with mantels, $2,400.

In the house shown on the left, one chimney answers for kitchen, dining room, and parlor. There is a large vestibule, direct entrance from same to parlor. Cellar extends under the whole house.

The front is 17′; side 36′, not including back pantries and front bay window. Height of cellar 7′, first story 10′, second story 9′.

The foundation brick, first and second stories clapboarded, except part of front and side gable, which is shingled. Roof shingled. Cost complete without furnace, $2,200.

Moses as a Sanitarian.

Dr. Birbeck Nevins, president of the Liverpool Medical Institution, recently delivered an inaugural address, in which he compared the sanitary arrangements of the ancient Hebrew camp with those existing in several large modern British cities.

With regard to the disposal of excreta, the lecturer recalled the stringent regulations of Moses, under which every man was to have a "paddle or shovel among his weapons," with which he was to dig a hole at an appointed place, and to cover up the excreta before leaving the spot. It has been insisted that nothing is so potent a disinfectant for such purposes in a hot climate as some six inches of dry porous earth; and it is worth noting that a high incentive of religious feeling was added to the sanitary obligation by the injunction: "For the Lord thy God walketh in the midst of our camp; therefore it shall be holy, and no unclean thing shall be in it." The same injunction necessitated a proper disposal of the dead, and it is lamentable to think how far we are behind the Israelites in this matter. They buried their dead entirely outside the camp; whereas, as Dr. Nevins states, Liverpool disposes of from 14,000 to 15,000 dead bodies in the ground in that city every year, thus necessarily polluting soil and air. As to the use of disinfectants in connection with the sacrificial processes, the lecturer pointed out that Moses was far in advance of us; for under the name of frankincense and other such titles, fragrant terebinthinate wood, and the volatile compounds of creosote and its allies, were largely used to deal with the animal exhalations arising in a hot climate from the processes under which large bodies of people are collected together for public worship. And, adverting to the scale on which these substances were employed, we are reminded that it passed into a saying that "the odor of the incense burned in Jerusalem was never absent from Jericho," which was twenty miles distant.

Dealing next with the question of clean or unclean meats, we find that the general rule was that the class of ruminants of clean feeding habits and wool-producing powers, but not other four footed animals, might be eaten. The horse, it is true, although a clean feeding animal, was not included, but this is regarded as being due to military considerations, which rendered it inexpedient to favor the multiplication of horses; besides which, the army of the Israelites was essentially composed of infantry. The fact that swine were but little better than scavengers of filth in those days naturally placed them in a different category to the animal that is nowadays very generally fed on nutritious meal diet and on sweet vegetables; and the prohibition as to mice is explained to have been essentially directed against the idolatrous practices of the Zabii. Much the same applies to the eating of blood, which is further an article especially liable to rapid decomposition With regard to the enactment that in the case of a nest containing young ones or eggs, "Thou shalt not take the dam with the young," Dr. Nevins is inclined to think that what we term a "close season" was here in view, and that the regulation, covering as it did all classes of birds, had reference to food supplies as well as to the maintenance of the balance of nature.

The prevention of the spread of disease is considered in connection with leprosy, a term which is held to have had application beyond the one disease to which that name is generally applied. Thus, the arrangements for dealing with the "leprosy of a house or garment" are considered, and grounds are given for the belief that some of the conditions that are described as calling for cleaning measures were very similar to "dry rot" and fungoid growths about dwellings, and had also in view what we would now call spores or microorganisms in connection with that which constituted the "leprosy" of ringworm, scarlatina, etc.—affections in which the clothing was altogether destroyed.

And lastly, before applying the several principles embodied in the Mosaic laws to the circumstances of his own and other large cities, Dr. Nevins deals with the subject of purifications and ablutions. For men, the purifications amounted mainly to bathing of the body and washing of clothes under circumstances which gave to these processes a distinct sanitary value; and it is impossible not to regard the purifications and ablutions, whether for one or other sex, as having had, and as still having, an important bearing upon the healthiness of the Jewish race. Indeed, in connection with the extraordinary care which is taken by this people as to purity of diet and as to bodily cleanliness, Dr. Nevins states that in all epidemics of cholera in Europe, record of which he has been able to find, the Jews' quarters have been those where the fewest deaths from this disease have occurred. There is this much in the history of this ancient people which affords proof of that which is at times regarded as a modern contention—namely, that there is no more potent influence for good in securing the maintenance of health than a strict observance of cleanliness in every detail of life.

To Tell the Age of a Horse.

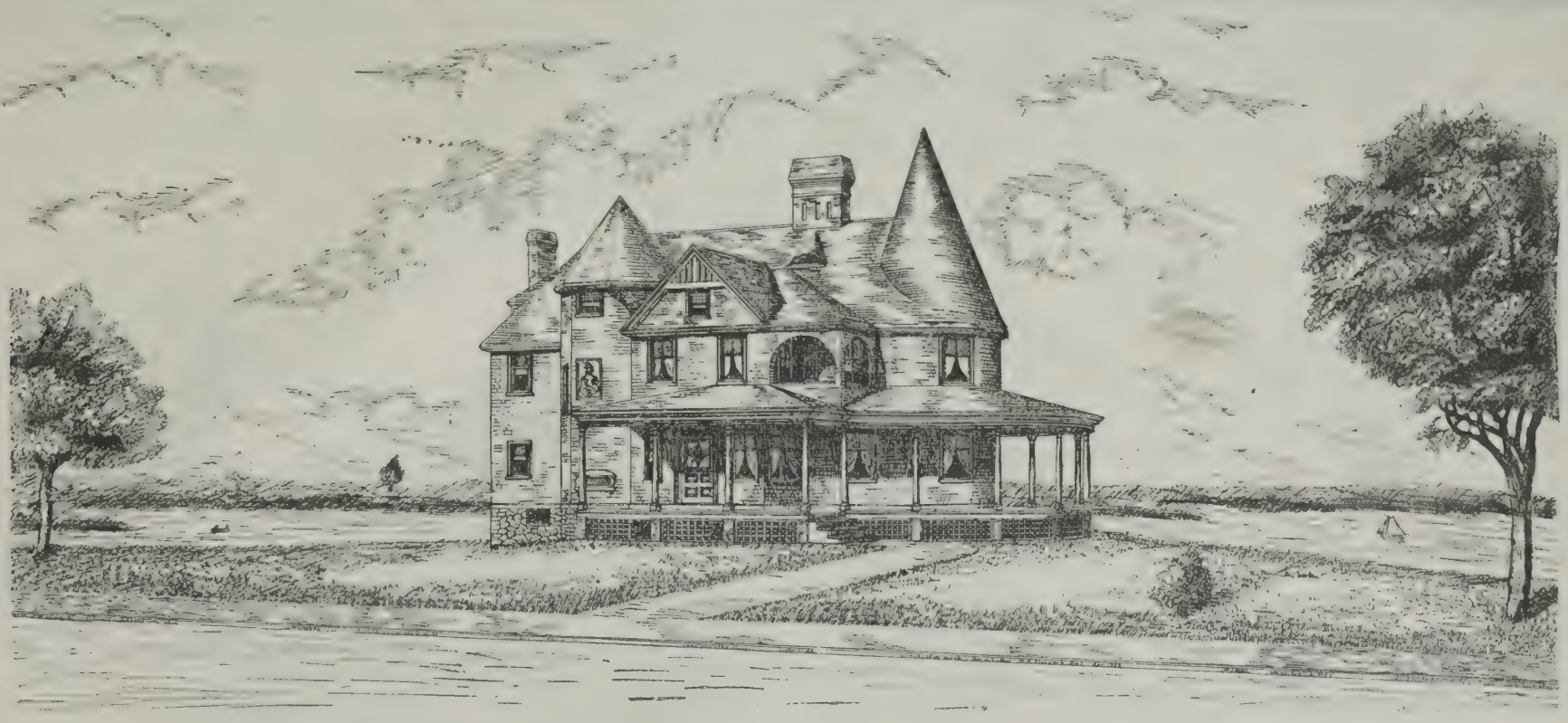
To tell the age of any horse,
Inspect the lower jaw, of course.
The front six teeth the tale will tell,
And every doubt and fear dispel.
Two middle "nippers" you behold
Before the colt is two weeks old.
Before eight weeks two more will come;
Eight months the "corners" cut the gum.
The outside grooves will disappear
From middle two in just one year.
In two years, from the second pair.
In three, the "corners," too, are bare.
At two the middle "nippers" drop.
At three the second pair can't stop.
When four years old, the third pair goes.
At five a full new set he shows.
The deep black spots will pass from view
At six years from the middle two;
The second pair at seven years,
At eight the spot each "corner" clears.
From middle "nippers," upper jaw,
At nine the black spots will withdraw;
The second pair at ten are white;
Eleven finds the "corners" light.
As time goes on, all horsemen know,
The oval teeth three-sided grow;
They longer get, project before,
Till twenty, when we know no more.

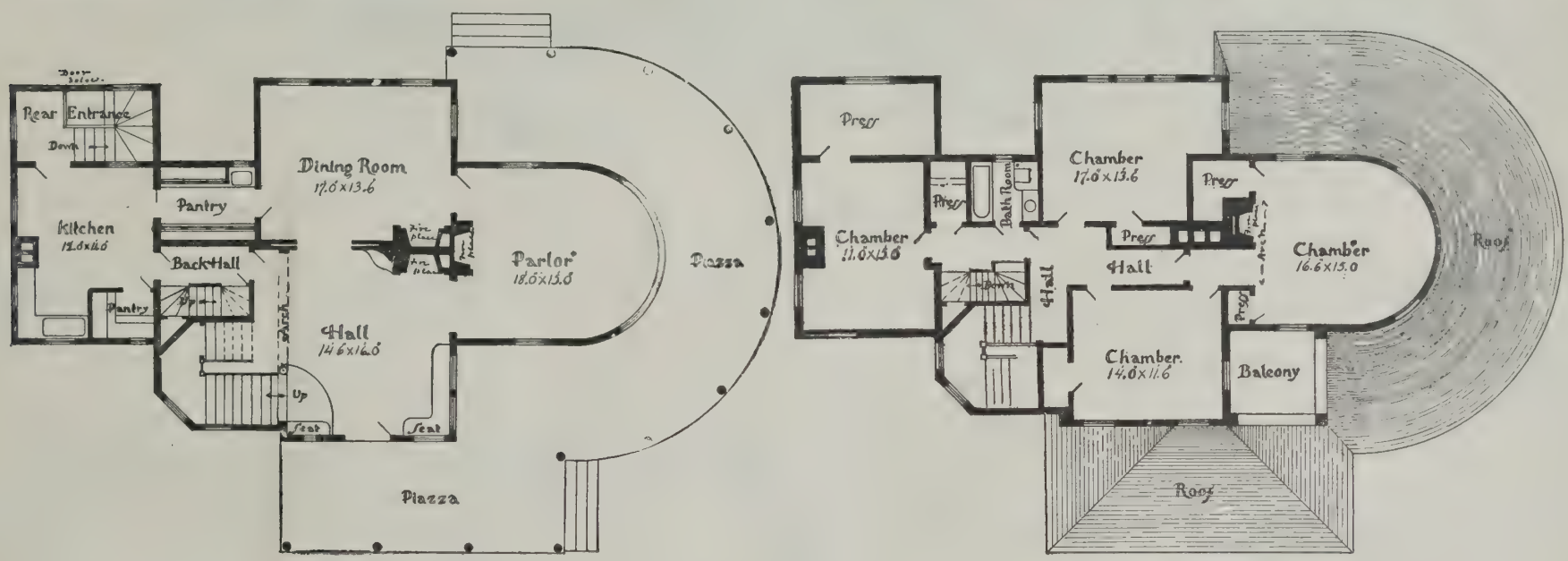
The Ventilation of Theaters.

Mr. Cosino J. Burton has published a statement respecting the condition of the air of the Theater Royal and the Royal Lyceum Theater, in Edinburgh, which are, of course, lit by gas. When the observations were made, these houses were not crowded, nevertheless, the temperature rose from ten degrees to fifteen degrees very shortly after the opening, while the proportion of carbonic acid was multiplied from three to five times. Mr. Burton remarks that the vitiation of the air by carbonic acid and organic matter proceeds at first with extraordinary rapility, but the rate of change of the atmospheric constituents soon decreases, till toward the end of the piece the air is little or no worse, and in a few instances may be found to have actually improved upon its condtion during the early part of a performance.

This phenomenon may be supposed to be due to the fact of the ventilation currents becoming brisker after the house is once thoroughly warmed. There were great variations in the pollution of the atmosphere in different parts of the theaters; the air of the gallery being considerably worse than that of any part of the house, and that of the pit being fuller than that of the dress circle, which was probably not so well filled. The late Dr. Parkes established that headache and vertigo are produced when the amount of carbonic acid in air intended for respiration is not more than from 15 to 30 volumes in 10,000; and there is only too much reason to believe the results obtained by Mr. Burton in the Edinburgh theaters would be paralleled by experiments in public buildings elsewhere.

IMMERSE steel or iron in a solution of carbonate of potash, and they will not rust.





Ground Floor Plan

Chamber Floor Plan.

A SEASIDE COTTAGE.

[For description see page 110.]

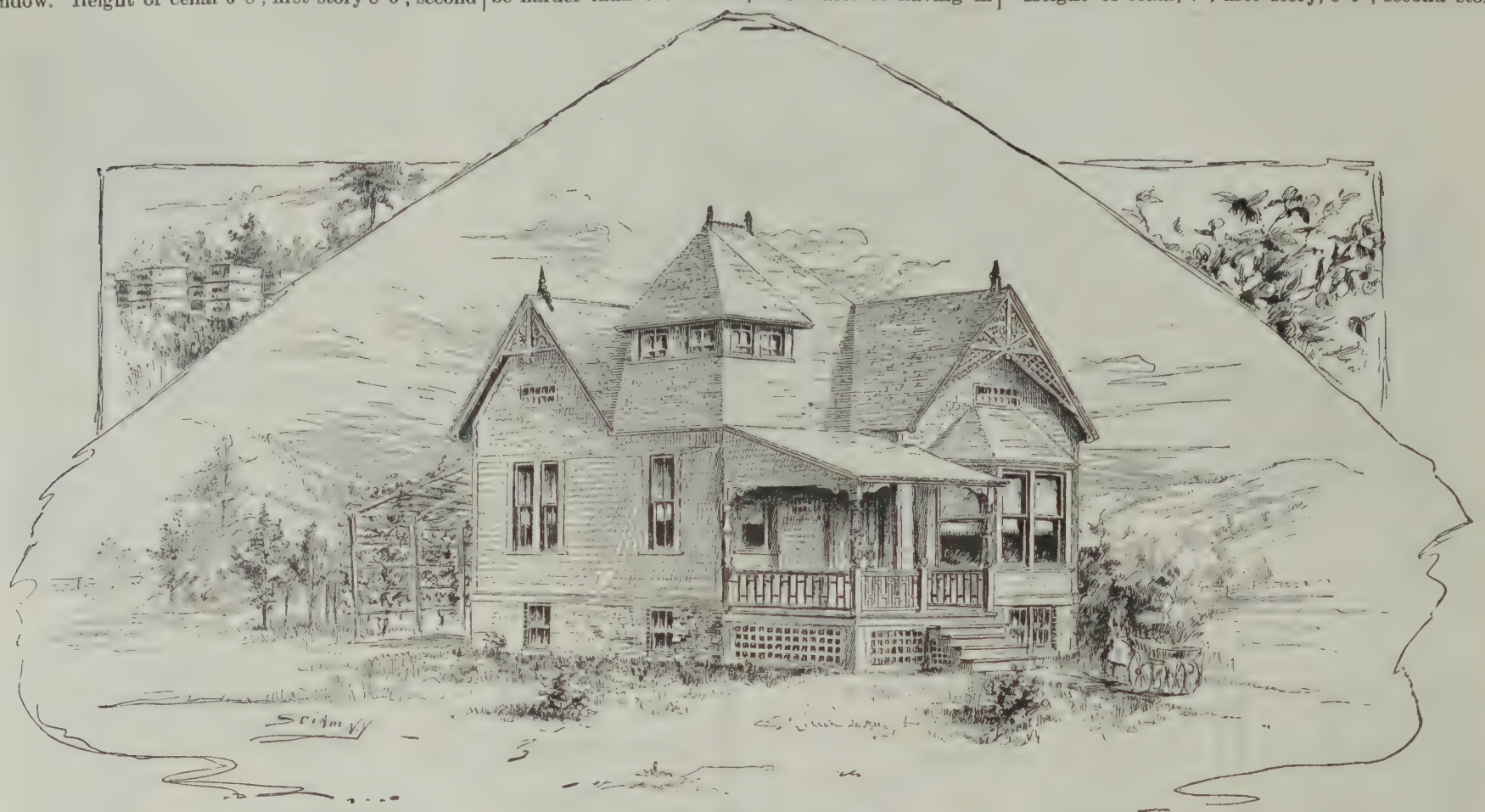
A RESIDENCE IN MINNEAPOLIS.

[For description see page 114.]

A COTTAGE FOR $1,800.

Front 24′, side 28′, not including the piazza or bay window. Height of cellar 6′ 8″, first story 8′ 6″, second story 8′ 6″, finished up to the roof. Foundation 8″ brick wall. First story clapboarded, second story and gables shingled, roof shingled. Cellar under the whole house. Cost $1,800.

This is a good design for a small suburban residence or seaside cottage.



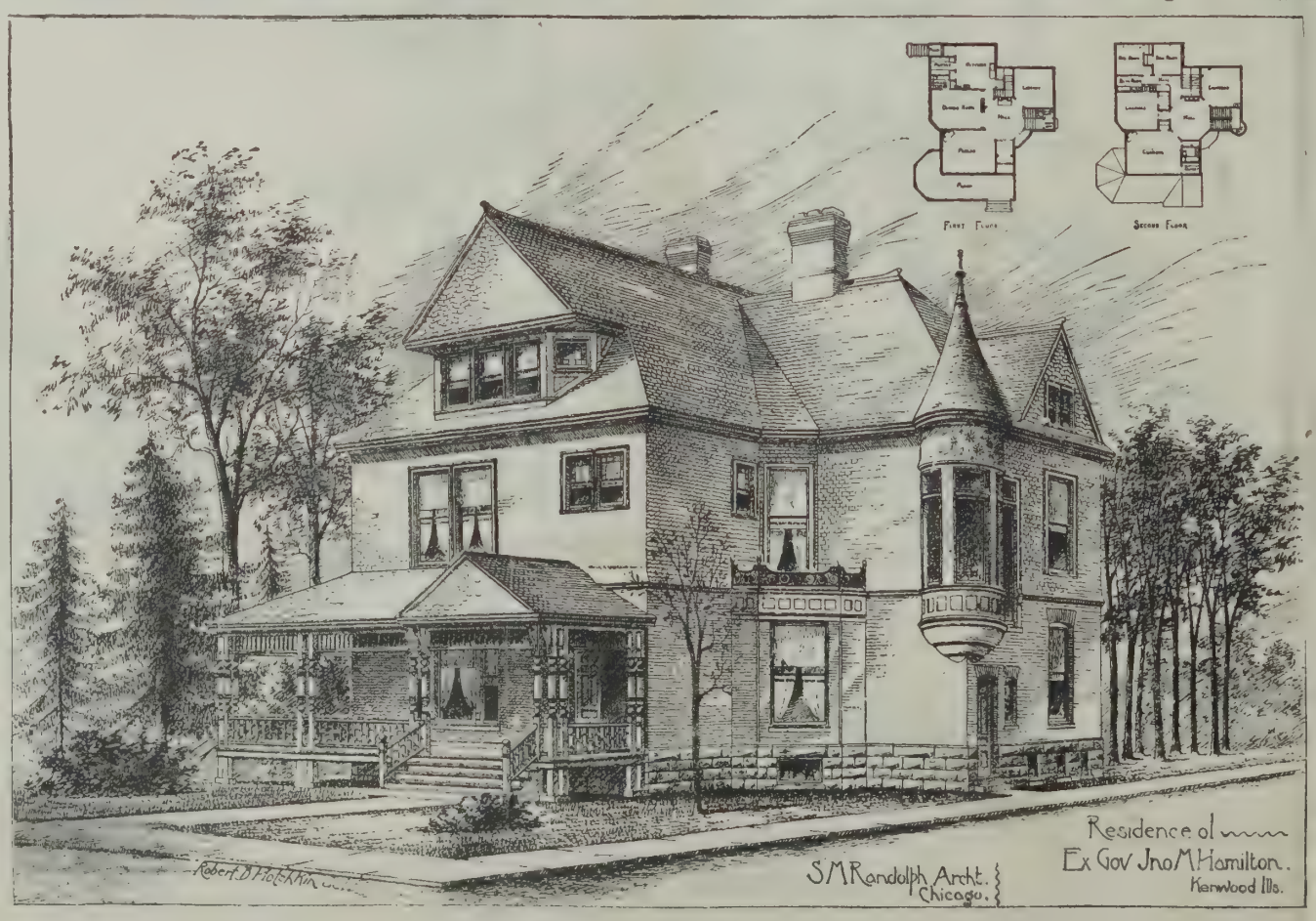
A COTTAGE FOR $1,800.

Ivory Gloss on Wood.

There are two kinds of varnish used to produce this white gloss—one a solution of colorless resin in turpentine, the other in alcohol. For the first, pure copal is taken ; for the second, sixteen parts of sandarac are dissolved in sufficient strong alcohol, to which are added three parts of camphor ; and lastly, when all are dissolved by shaking, five parts of Venetian turpentine are added. In order to cause the color to remain a pure white, care must be taken not to mix the oil with the white paint previously put on. Best French zinc paint mixed with turpentine is to be employed. When dry, this is rubbed down with sand paper, and this is followed with the application of the varnish above described.

A RESIDENCE IN KENWOOD, ILLINOIS.

We give a sketch of the residence of Ex-Gov. Hamilton, for which we are indebted to the *American Architect*. It is a pleasing and well proportioned house.



A RESIDENCE IN KENWOOD, ILL.

Bricklaying in Frosty Weather.

Mr. Mitchell, British Consul-General at Christiania, referring to a previous report of his on the practice of Norwegian builders to work in the coldest weather, says in a communication published in the *Board of Trade Journal:* "As a striking confirmation of the durability of work done under such circumstances, I have the honor to report that five courses of a house wall laid on the 10th of March in 1·75° Fahr. had to be pulled down on the 12th and 13th, owing to a mistake made by the contractor, and that the mortar, when attacked with crowbars, proved to be harder than the bricks; the fractures having in many cases run across the bricks instead of following the mortar joints."

A SEASIDE COTTAGE.

We give a perspective and floor plans of a convenient and comfortable cottage, lately completed on Rumstick Neck, Barrington, R. I., and designed by Edward I. Nickerson, architect, Providence, R. I. This point separates the mouth of Warren River from Narragansett Bay, and there is an extended view in all directions. The construction of the house is very thorough. The cost about five thousand dollars.

A COTTAGE OF FIELD STONE AND WOOD.

These plans, by Mr. Angus S. Wade, architect, of Philadelphia, show three rooms and hall of good size on first floor, and two large rooms, hall and bath room on the second floor. Convenient closet room throughout. The balcony on second story gives a very attractive appearance to the structure. This is an excellent house to be located near a mountain or a grove. The materials, for the most part, can be obtained in almost any country place, being all of rough nature, common field stone being used in general. There is a cellar under the whole house.

The front is 28′, side 24′, not including porch and shed.

Height of cellar, 7′ ; first story, 8′ 6″; second story, 8′. The walls are rough field stone. The roof and other wood work outside is covered with rustic shingles. Moderate cost.

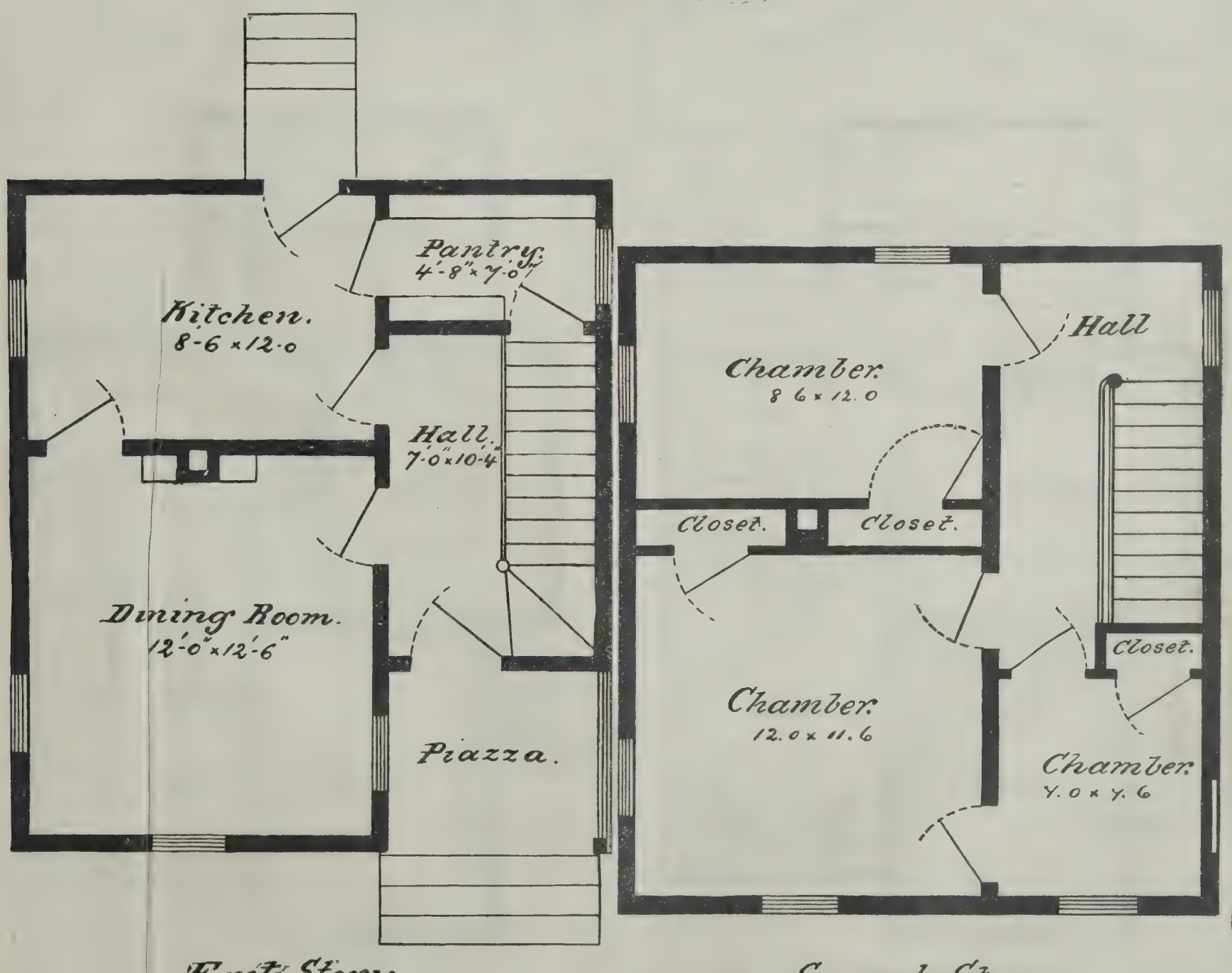
Originality in Architecture.

Originality in architecture is not likely ever to be manifested in an absolute sense. The various forms of detailed construction, such as arches and columns, which are scattered over the surface of the globe, may have exhausted the combinations of possible forms, and I do not think we need concern ourselves with the question of the invention of a new style of architecture. It is, indeed, not necessarily creditable to an architect to have done that which has never been done before, for he may have neglected considerations which have very properly prevented others from falling into mistakes in which it may be he is foolish enough to glory. If we realize properly the true nature of our art, we shall not be always seeking for novelty as the chief desideratum. Architecture is the outcome of accumulated experience, and we cannot, therefore, imagine that we are wise enough to dispense with the assistance which such experience offers to us. To do so would be to destroy the scaffolding before we have raised the building. An originality, again, which is sought for only in strange and startling combinations is more often than not no originality at all, but merely a tasteless jumble of discordant details which may have struck the fancy of the young architect at different times and places. Our architecture must be reasonable, for we have to bear in mind that men do not erect buildings to please architects, but to serve their own needs and purposes. If this necessity be (as doubtless to some extent it is) a difficulty in the way of originality, it will, nevertheless, if fairly recognized, save us from some other snares which lie in our way in the direction of imitation. Our architecture

must, as we know, be affected by a variety of causes external to ourselves, such as climate, and there are other influences which I may call external which are not less powerful.—*E. M. Barry.*

A COTTAGE FOR $1,050.

Front 20′, side 22′. For size of rooms, see floor plans.



A COTTAGE FOR $1,050.

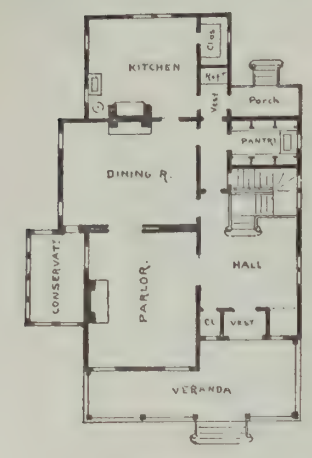
Height of cellar, 6′ 8″ first story, 8′ 6″ ; second story, 8′. Foundation, 8″ brick walls. First and second stories novelty boarding, gabes shingled, roof shingled. Cost complete, $1,050. Cellar under whole house.

"PROPORTION maybe fairly said to be the soul of architecture."

Painting and Varnishing Floors.

A French writer observes that painting floors with any color containing white lead is injurious, as it renders the wood soft and less capable of wear. Other paints without white lead, such as ocher, raw umber, or sienna, are not injurious, and can be used with advantage. A recipe for a good floor varnish is given as follows : Take 2 lb. of pure white borate of manganese finely powdered, and add it little by little to a saucepan containing 10 lb. of linseed oil, which is to be well stirred, and raised to a temperature of 360° F. Heat 100 lb. of linseed oil in a boiler till ebullition takes place. then add to it the first liquid, increase the heat, and allow it to boil for twenty minutes. Then remove from the fire, and filter the solution through cotton cloth. The varnish is then ready for use, two coats of which may be used.—*Building News.*

IF any of our readers have made an invention for which they have thoughts of taking a patent, they are invited to communicate with Messrs. Munn & Co., the publishers of this paper, who for a period of forty-three years have conducted a most successful bureau in this line. A pamphlet of instructions will be sent free, containing full directions how to obtain a patent, costs, etc. In very many cases, owing to their long experience, they can tell at once whether a patent probably can be obtained ; and advice of this kind they are always happy to furnish free of charge. Address Munn & Co., SCIENTIFIC AMERICAN office, New York.

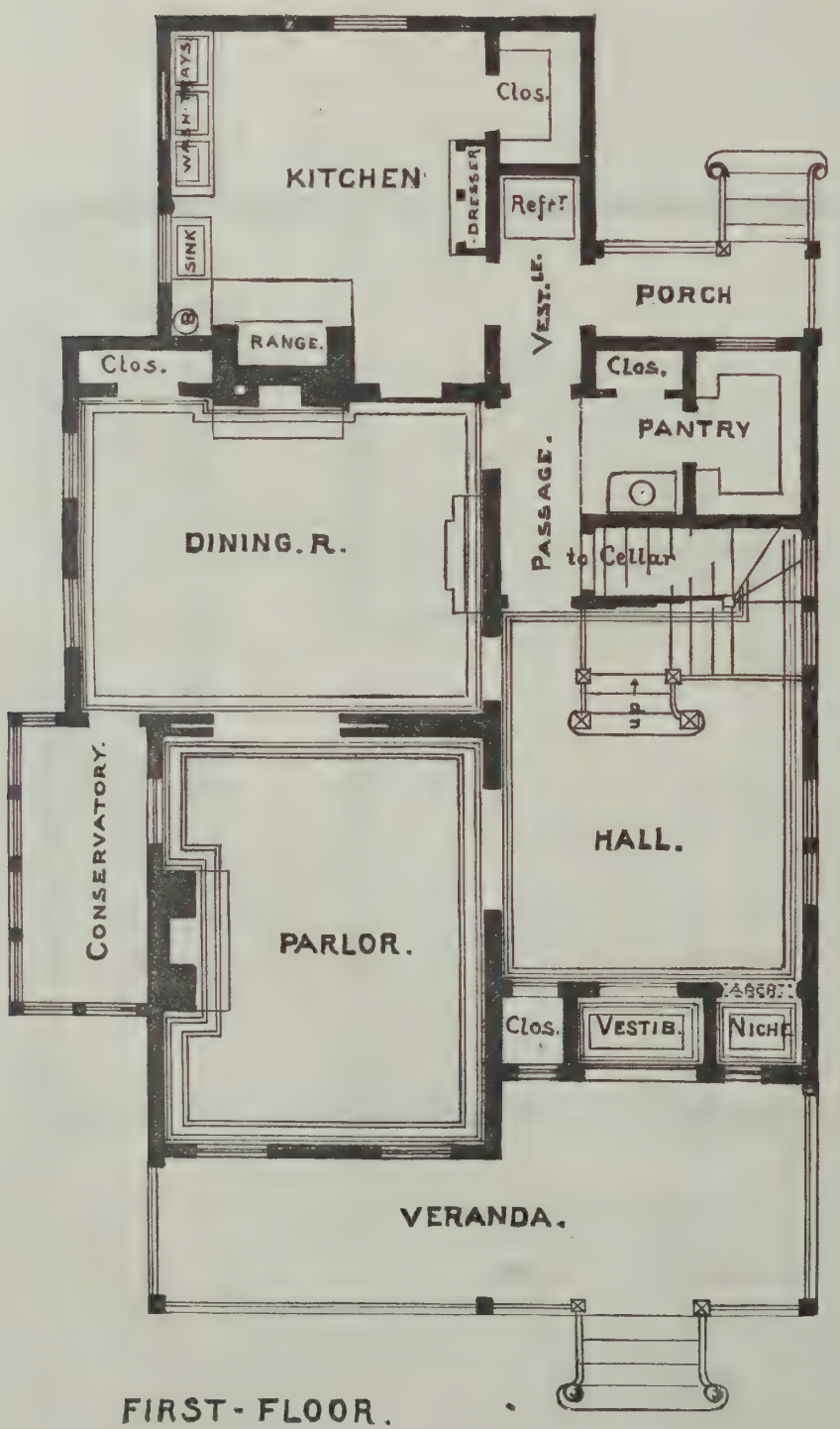


SCALE 1/16 in. = 1 ft.

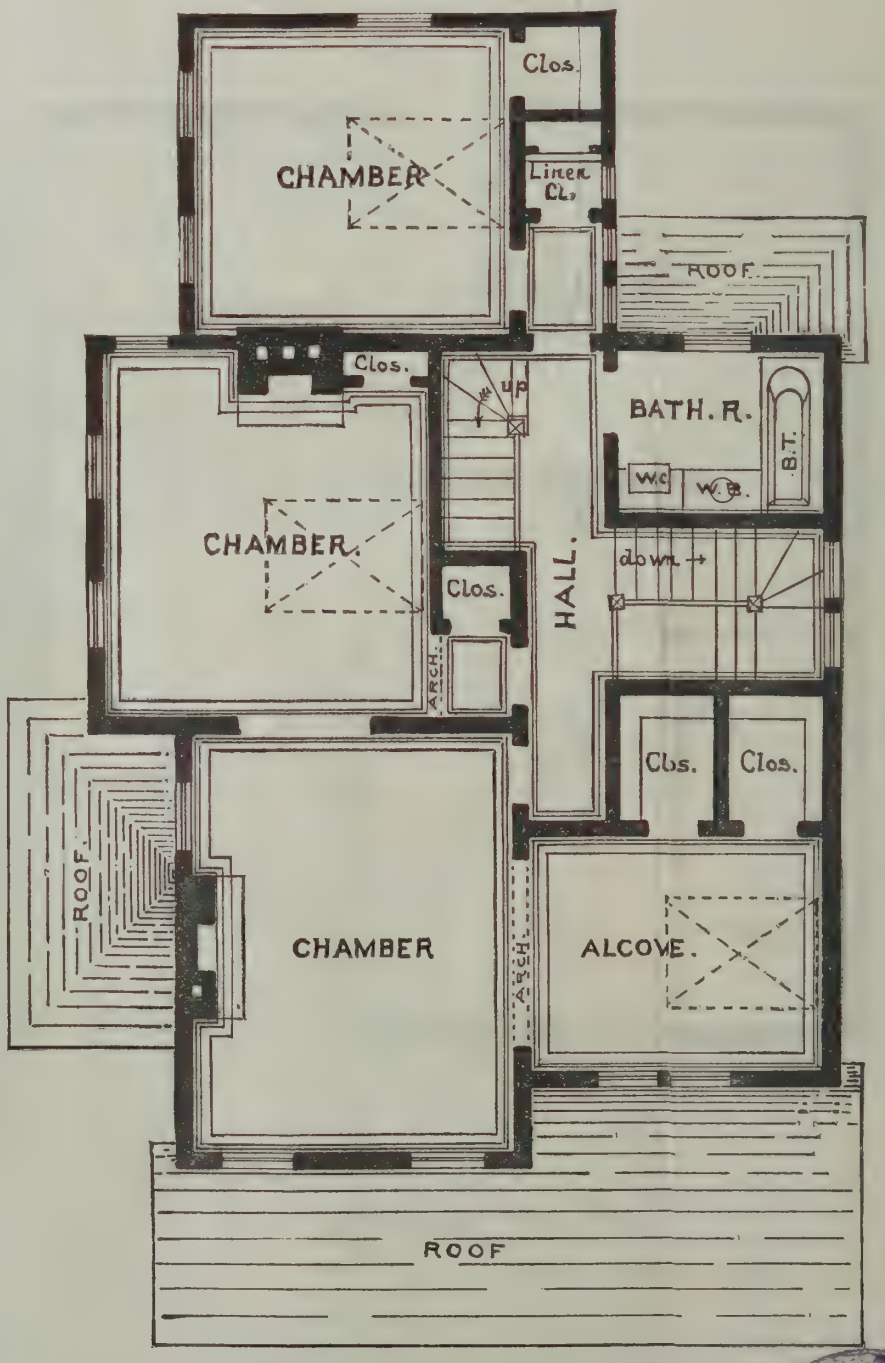
COTTAGE AT MORRISSANIA
for Wm. HAENNEL esq.
N.Y.

SCALE 1/8 IN. = 1 ft.

GEORGE H. GRIEBEL
Architect,
67 WEST 23rd STREET.



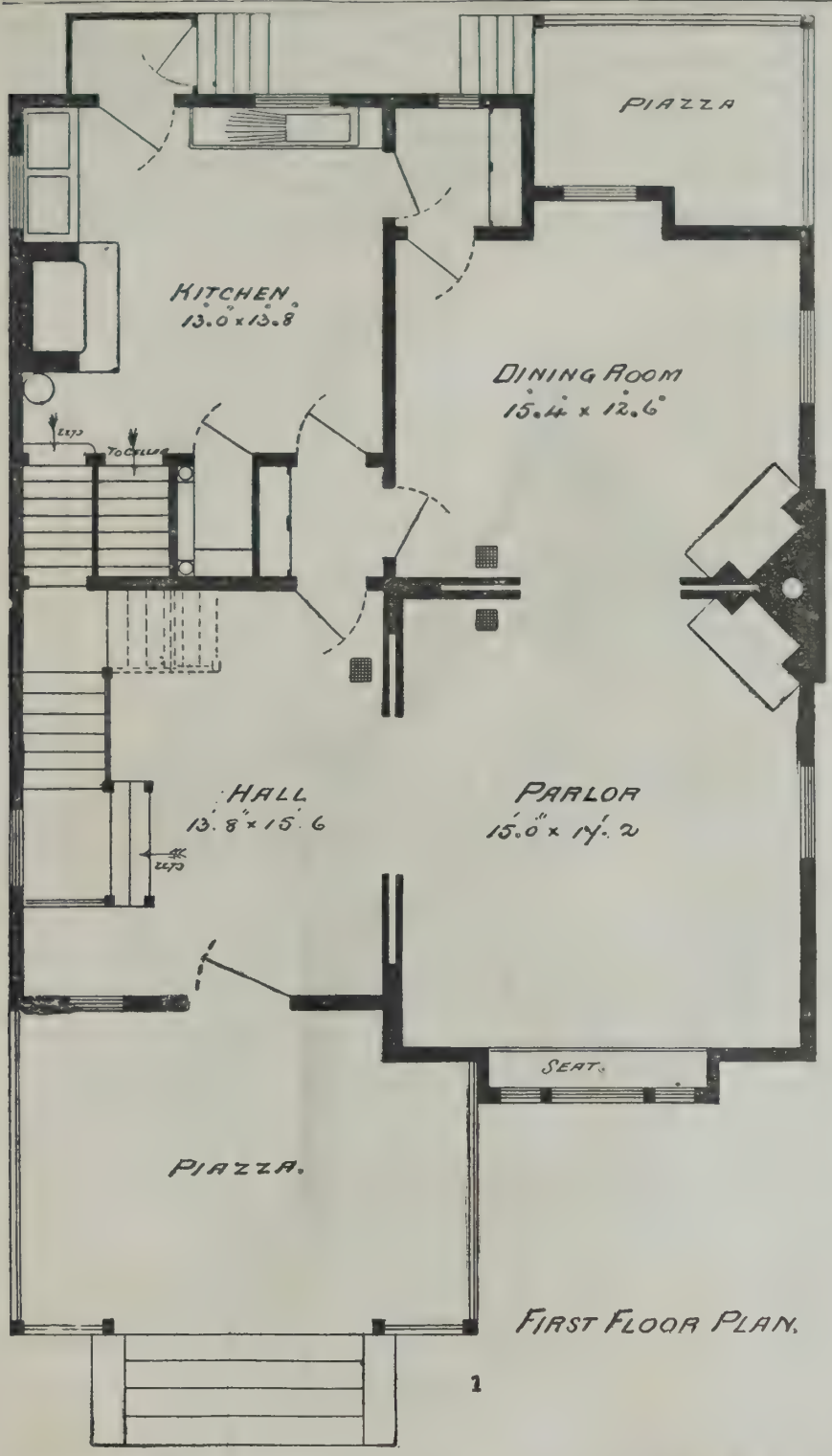
FIRST-FLOOR.



SECOND FLOOR.

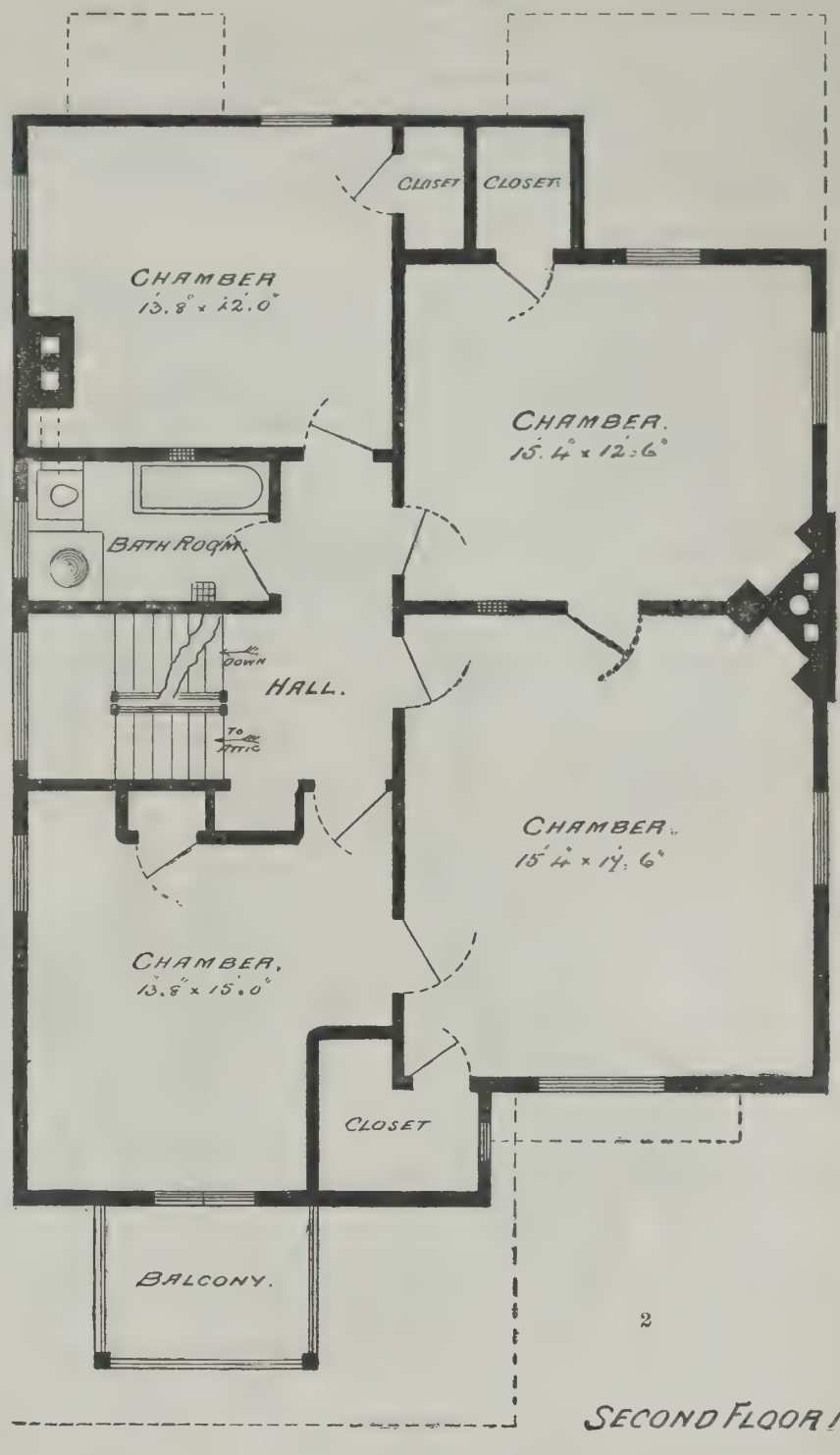
A COTTAGE ON PROSPECT AVE. AND 165TH ST., NEW YORK.

[For description see page 114.]



FIRST FLOOR PLAN.

1



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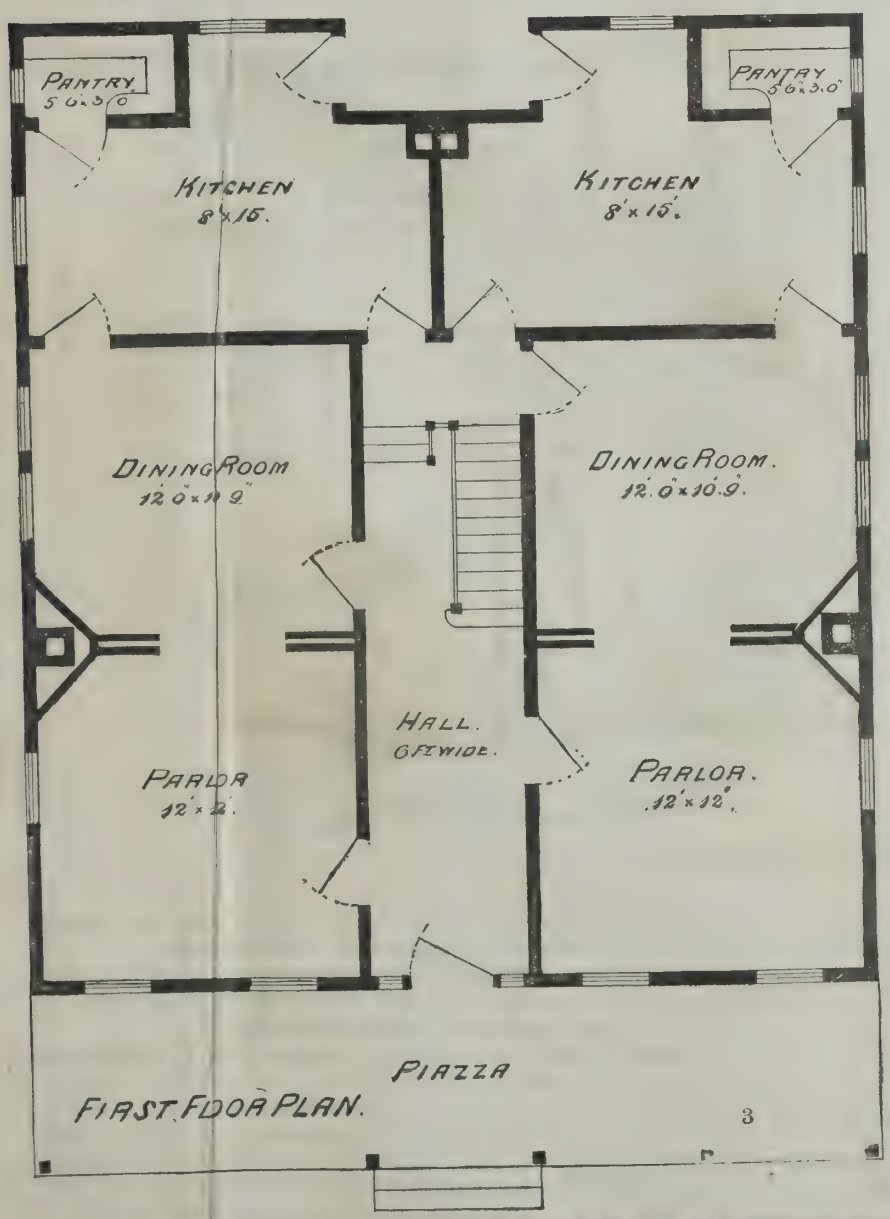
SECOND FLOOR PLAN



FIRST FLOOR PLAN.

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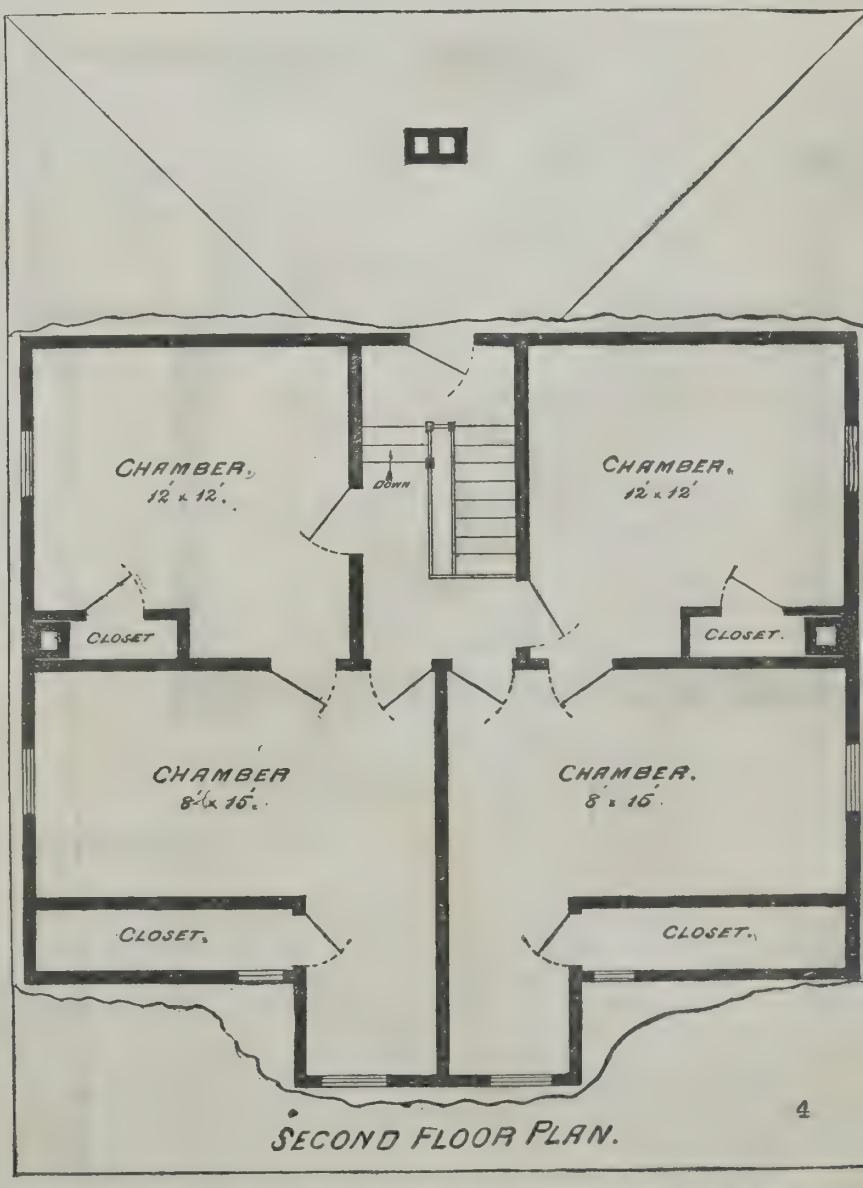


SECOND FLOOR PLAN.

4

PLANS TO ACCOMPANY COLORED PLATES GIVEN IN OUR MAY NUMBER 1888. Figs. 1, 2—COTTAGE OF MODERATE COST. Figs. 3, 4.—A DOUBLE HOUSE FOR $2,500

RESIDENCE OF MODERATE COST.

This design, by Mr. Angus S. Wade, architect, Philadelphia, Pa., shows three rooms, hall, and shed on first floor, all good medium size, with three bed rooms and bath room on the second story, Each room has a closet conveniently located. It is an attractive house for a suburban residence. The principal part of the materials being rough stone, can be obtained in almost any country place at small cost. The front is 28′; side, not including shed, 26′. Shed about 8′ × 12′. For size of rooms see floor plans. Height of cellar, 6′ 9″. First story, 9′ 6″. Second story, 9′.

Materials: First story, rough stone. Second story and side gable, shingled; two gables, gables paneled; roof, shingled. Cellar, ordinary rough stone.

A RESIDENCE IN MINNEAPOLIS.

We give a sketch of a residence for Mr. Wm. Donaldson, by Long & Kees, architects, for which we are indebted to the *N. W. Builder, Decorator and Furnisher.*

A COTTAGE ON PROSPECT AVENUE AND 165TH STREET, NEW YORK.

Situated in one of the most attractive portions of Morrisania, this cozily arranged cottage, surrounded by trees and gardens, is a very desirable property.

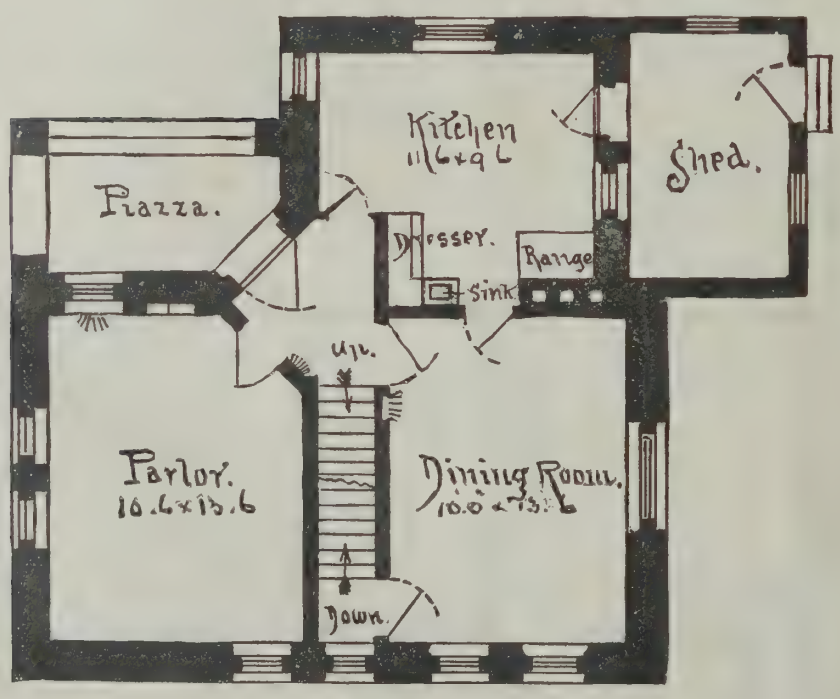
It was built for the owner's own use, and according to his own ideas of comfort, in the most substantial manner and of the best materials and workmanship.

One of the main features is the large hall, well lighted and ventilated, and especially well adapted as a general sitting room, communicating with every room in the building, and being of large size, so as to allow of being handsomely furnished. The building is a frame structure, the cellar walls alone being masonry. The broad veranda well shades the front, the vestibule and the bath room in second story are handsomely decorated with solid relief tinted in quiet colors corresponding with the oak trimmings and tile floor. The solid relief work was done very creditably by Henry Fechteler.

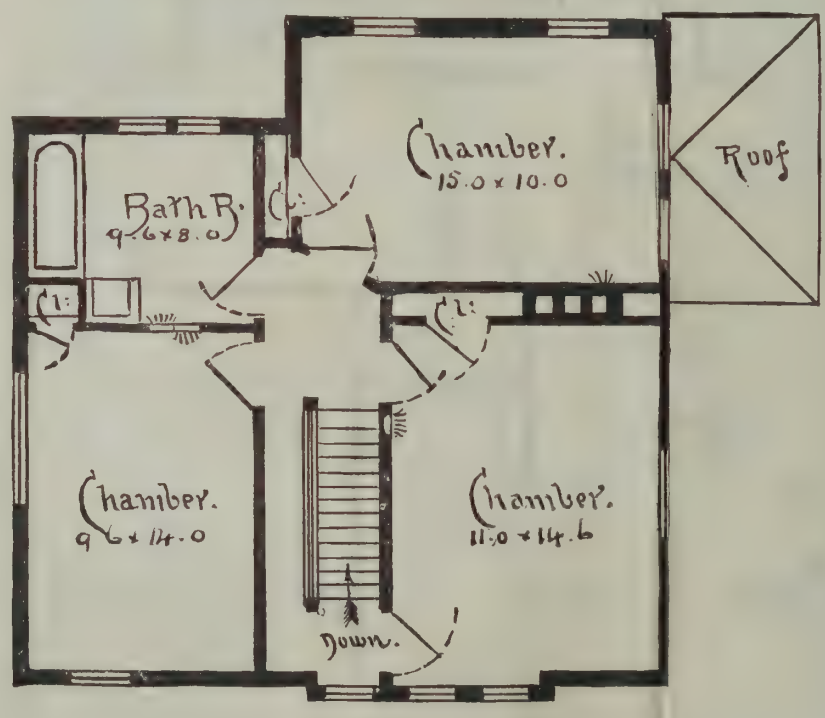
The trimmings in vestibule are oak antique, stairs and halls of ash. Especially worth mentioning are the mantels in parlor (mahogany), in dining room (oak natural), all made to especial designs. The style throughout is unassuming, and the interior in every respect cozy and complete. The building is heated by steam. The plumbing is the best, both in materials and workmanship. The house is wired for electric gas lighting, electric bells, burglar alarm, etc., all complete. There is a neat little conservatory adjoining the dining room, connected by window with the parlor, and a large studio in attic. Every rom has spacious closets, besides linen closet, storerooms, etc.

Mr. Haehnel is laying out the ground in a most tasty manner, and the building before log will be one of the ornaments of the neighborhood.

Entire cost, $7,000. Architect, Ge. H. Griebel, 67 West 23d Street.



First Floor Plan.



Second Floor Plan.

A RESIDENCE OF MODERATE COST.

Near the town of Soleure, in Switzerland, a bird's nest was recently found which was constructed entirely of imperfect watch springs thrown out from the workshops. It has been deposited in the local museum.

RECONSTRUCTION OF THE ST. LAZARE STATION, PARIS.

For a number of years, the St. Lazare railway station has not been well answering the requirements demanded of it. The entanglement of its freight buildings and the same yards being used for arrivals and departures has all conspired to produce confusion and obstruction. It is now three years that the company has been working on the entire reorganization of the whole station and the construction of new buildings. The new establishment is to be entirely finished at the time the Exposition of 1889 opens.

The first structure erected stands at the angle of Rome Street and the Bridge of Europe. This is occupied by the rolling stock. At the other extremity of the bridge, on the Batignolles side, the freight building is going up. This is an iron and brick hall established upon stone pillars and iron beams above the railway tracks. The cars are lifted to the level of the street by means of very powerful hydraulic elevators. The accumulators of water under pressure which transmit power to the elevators and loading and unloading devices are located at the Batignolles freight station, and send the water through conduits laid under the roadbed.

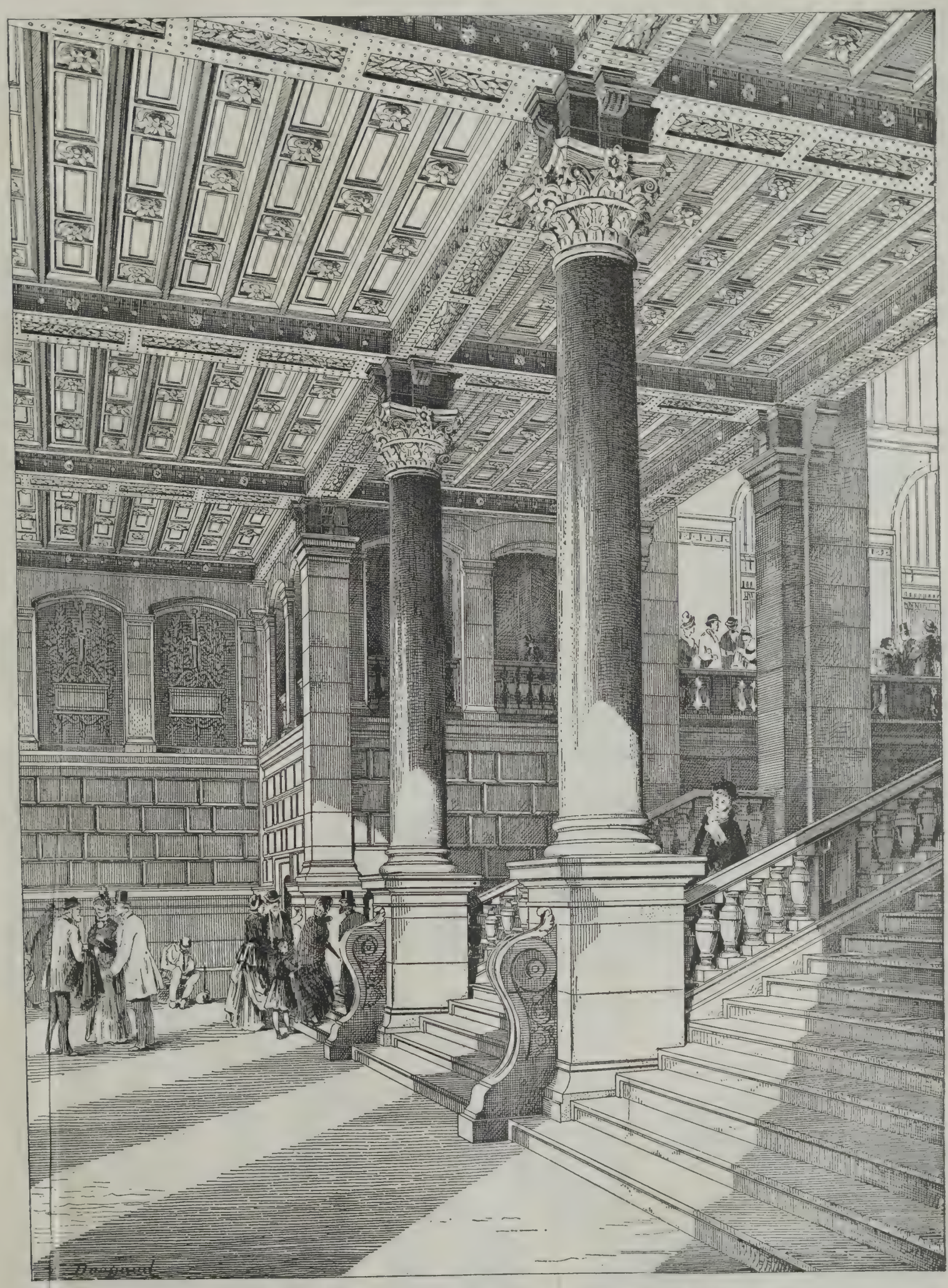
Of the station properly so called, the great hall of the Pas-Perdus will be preserved, and this will be enlarged toward the exterior to make room for the ticket offices.

Two angle pavilions, situated, one of them, at the corner of Rome Street, and the other at the corner of Amsterdam Street, will form the two extremities of this hall. One of these pavilions is now finished.

The new front thus occupies considerable extent of ground. The view of it will be partially hidden by a terminus building which will be erected between St. Lazare Street and the railway station, occupying the entire length of the Pas-Perdus hall, from which it will be separated by a new street. It is on this street that suburban travelers will land, and at the landing platforms there will be staircases allowing of a descent under the Pas-Perdus hall.

Mr. Lisch, the company's architect, has the direction of this important work.

A monumental stairway will occupy the center of each of the end pavilions. One of these is shown in our engraving.—*La Construction Moderne.*



GRAND STAIRWAY OF THE ST. LAZARE STATION, PARIS.

The Architect and Builder.

Let us pause and look back through the dim vista of the past. What wonders upon wonders have been achieved since the time of the tent and the cave! Although it may be thousands of years, yet the great advancement strikes one with awe; and with all this advancement in the science of architecture, everywhere throughout the habitable globe countless monuments attest not only the skill and ability of the architect, but of the builder as well. Yes, the architect and the builder go hand in hand. They are, figuratively speaking, Siamese twins, each dependent on the other; for, without the mechanical ingenuity and skill to execute and carry out designs, there would have been no architecture. And, finally, to sum up, if there had been no architects, there would have been no *architectural designs;* if there had been no skillful mechanics, there would have been no *executed* designs; if there had been no properly taught apprentices, there would have been no skillful mechanics; if (as in the present day) journeymen had been permitted to dictate to the bosses, and say to them, "You must not take apprentices," there would have been no apprentices, either properly taught or otherwise. If the art, science, and skill of building are to continue the glory of the past, we *must have* apprentices; and if so, their early training must be in the direction of their proposed calling, their education thorough and complete, commensurate with the times.—*A. C. Nash, Address before Nat. A. of Builders.*

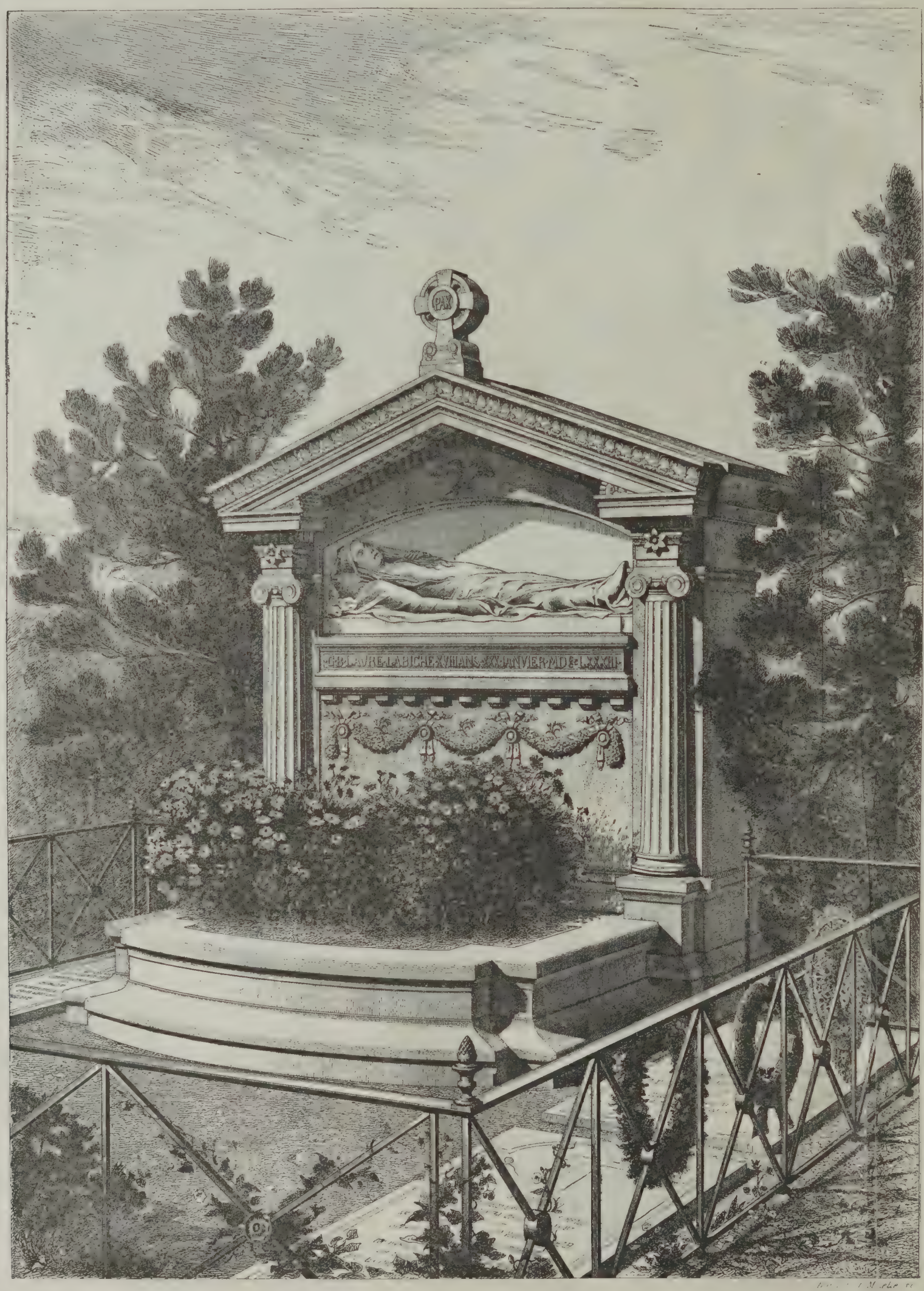
Proceedings of the National Association of Builders.

We have received from the Association a copy of the official report of the second annual convention, held at Cincinnati, Feb., 1888. It comprises a volume of 150 pages, and covers a variety of interesting subjects which were discussed and disposed of. The Association is in a position to wield an immense power for good among all whose occupations are in any way connected with building. The membership embraces many earnest, practical, intelligent men. The next convention is to meet in Philadelphia, second Tuesday of February, 1889. The president is John S. Stevens, of Phiiadelphia; secretary, Wm. H. Sayward, Boston.

TOMB IN THE CEMETERY OF BEVILLE.

The tomb of Miss Labiche, daughter of the Senator of Eure-et-Loir, appears to us to combine the three essential elements of funereal expression—the idea of death, the respect paid to death, and the religious invocation apropos of death. Thes three ideas or sentiments have been summed up by our editor, in his Funereal Architecture, in these three words: Death, Glorification, and Faith.

We see the emblem of Faith orreligious invocation in the cross that surmounts the fonton crowning the structure. Is not Death symbolized by the body of the maiden which the soul has just left under the form of a bird flying toward the celestial regions? As for the respect paid to death, this, in ouropinion, is the mon-



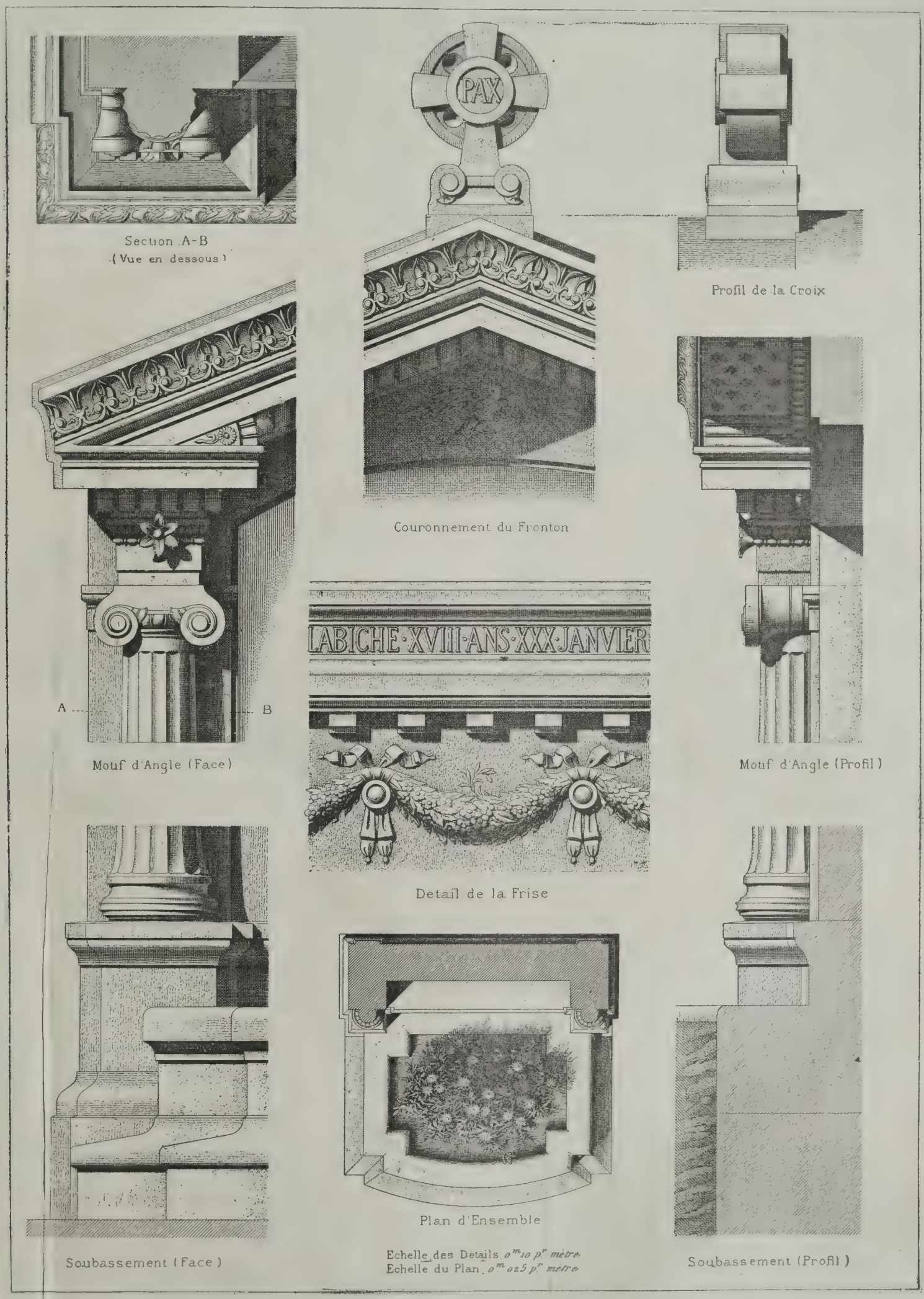
TOMB IN THE CEMETERY OF BEVILLE—H. P. NENOT, ARCHITECT.

ument itself, rising with all its majesty in the midst of tombs covered with simple slabs, the whole surrounded by a railing without any pretension, forming an inclosure to the family burial ground. What was purer or better in the family than this child, so ruthlessly snatched from the affection of her kindred when she had scarcely crossed the threshold of her existence? Is it not this that has inspired the designer of the monument with the idea of glorification?

of Euville stone save the statue, which is of Carrara marble, and due to the chisel of Mr. Chapu. The decorative sculpture was executed by Mr. Legrain. The contractor was Mr. Devoisine.—*Revue de l'Architecture et des Travaux Publics.*

Senator Stanford's $100,000 Tomb.

The architect who planned the magnificent mausoleum of Senator Stanford at San Francisco says that portation alone will be a large one, as the granite will all be shipped from Vermont and the marble from Italy. The site selected is a beautiful four-acre plot in the Senator's grounds, just outside of San Francisco. It already contains handsome shrubbery, and occupies an altitude commanding a magnificent view of the bay. A driveway sixty feet wide will be made, circling around a slight elevation, on the brow of which will be the tomb. The art of the landscape gardener will be



DETAILS—TOMB IN CEMETERY OF BEVILLE.

Proceeding to a minuter analysis of the work, what is there more touching than this maiden sleeping her eternal sleep, protected by the projection of the fronton which thus forms a sort of canopy, the starry under-surface of which represents the celestial vault? Happy, too, was the selection of the Ionic order—the *feminine* order *par excellence*—for the columns upon which the angles of the fronton rest. Finally, from the boldly outlined vase that covers the tomb projects a dense mass of daisies (favorite flowers, perhaps), an emblem of the maiden who died in the springtime of life.

The monument, which dates back to 1885, is entirely it will be the most elaborate repository for the dead ever built in this country. In style of architecture the simple but effective methods of the ancient Egyptians will be followed. Massive imperishable granite, of a light shade of gray, with an interior lining of the finest Italian marble, will be employed. The item of expense has not been considered, the designers being given *carte blanche* as to cost and directed to secure the best of material and workmanship to be had.

The total outlay necessary to complete the tomb and prepare the surroundings will reach $100,000, and may considerably exceed that amount. The item of transemployed to beautify the approaches and render even more effective the vistas of the park.—*New York Mail and Express.*

Fig. 1.—MODEL COTTAGES OF LOW COST.

Fig. 2.—RESIDENCES, NORTH ST. PAUL.

Fig. 3.—ST. PAUL KENNEL CLUB, SILVER LAKE.

Fig. 4.—RESIDENCE OF C. B. McKENNY.

Fig. 5.—PUBLIC SCHOOL.

Fig. 6.—RESIDENCE OF E. S. OSORN.

ILLUSTRATIONS OF NORTH ST. PAUL, MINNESOTA.

Italian Marble.

Leghorn is the great market place for Italian marble. It arrives there in coasters so heavily laden that a stranger wonders how they can live through the sudden gales. The *navicelli* employed in the trade are as good a school for sailors as the English colliers. Mr. Lee describes the mode of stowing marble as almost a fine art. The cargoes, he says, are usually made up with light goods, of which pumic stone, hemp, oil, and sumac form the principal part. Care has to be taken to keep the marble safe from the oil and sumac, especially from the sumac, as it may impart a deep purple stain. The principal market is America, which takes one-fourth of the quantity exported. France takes 25,000 tons annually, Great Britain 18,000 tons, principally slabs, which are admitted free of duty.

Masonry and Cement.

According to a report upon masonry prepared by M. Emil Kuichling, member of the American Society of Civil Engineers, for the Executive Board of the city of Rochester, New York, the secret of good masonry lies in strong, thick mortar and wetted stones. Workmen commonly make mortar too wet or thin, in order to save trouble in working it; but this is always attended with loss of strength. After a period of about a year weak mortars often lose in strength or tenacity what they gain in hardness, from the fact of their becoming brittle. Specimens of such mortar two years or more old break very irregularly. The standard of tensile strength required of Portland cement mortar by German engineers—the briquette being prepared by mixing 1 unit by weight of cement with 3 units of normal sand and 0·4 unit of clean fresh water—was formerly 114 lb. per square inch, broken after an exposure of one day in air and 47 days in water. A few years ago the standard of breaking strength for a slow-setting cement was raised to 142 lb., and at the present time it is 227 lb. per square inch. For quick-setting cement slightly lower strengths are admitted. For the harbor works of Calais and Boulogne, the French engineers required a tensile strength for neat cement of 284 lb. per square inch after 7 days, 498 lb. after 28 days and 640 lb. after 84 days. According to English authorities, Portland cement, tested neat, should give a tensile strength of at least 200 lb. per sq. in. after seven days' immersion in water, and when gauged with three parts of sand to one of cement, should stand a strain of 112 lb. per sq. in. after one day in air and 27 days in water.

THE NEW CITY HALL HOLYOKE MASS.

Temple of Jupiter Olympius.

At a recent meeting of the Royal Institute of British Architects, Mr. F. C. Penrose, M.A., read a paper on "The Temple of Jupiter Olympius at Athens, and some Recent Excavations on the Site," of which the following is an abstract:

Mr. Penrose considered that no ruins of classical antiquity were perhaps more impressive than the columns of the Temple of Jupiter Olympius, and that the group of thirteen at the southeast corner gave a suggestion of intricacy, while those near the western extremity evidenced about the original length. The temple had been completed just before the extinction of paganism, but had been in progress for about 650 years, reckoning from its first foundation by Pisistratus. Having read a short description of the temple by Pausanias, Mr. Penrose referred to a drawing by Carrey, the artist who accompanied the Marquis of Nointel, the French ambassador at Constantinople in 1674, which showed that a small church then existed among the group of thirteen columns, a portion of the campanile of which was still visible in 1848, but since taken down.

Spon and Wheler, who had visited Athens about the same date, described the sixteen columns of the temple and the small church—St. John of the Columns. Stuart mentioned a seventeenth column, which was shortly after taken down by a Turkish governor for the sake of the material. In 1845-47, when Mr. Penrose was at Athens, sixteen still existed—the group of thirteen and three isolated columns The middle one of the latter, however, was blown down in 1852. The existing columns were remarkable both for their great size and extraordinary beauty. The character of the foliage on the capital in the neighboring Arch of Hadrian was much inferior, that on capitals of the columns of the temple being very fine and resembling in a marked degree the early Corinthian example of the Tholus at Epidaurus, about 410 B C.

Mr. Joseph Woods, speaking of the probable date of the ruins of the temple, discussed three possible periods—Antiochus, Augustus, and Hadrian—and referred the date to the time of Augustus, several particulars rendering it probable that the work was earlier than Hadrian's time. Except for the assumed transportation to Rome of the columns erected under Antiochus, Mr. Woods himself was disposed to refer them to the time of that monarch, and, with regard to the transportation, Mr. Woods remarked that there was no column, or portion of a column, of large diameter of Pentelic marble in Rome. The author was of opinion that the columns were of the time of Antiochus, arguing that a column built of a number of drums could not be taken down and refixed without utterly spoiling the perfection of the joints, on which the ancients so prided themselves. Mr. Woods indorsed his opinion as to the beauty of the workmanship and the effect produced by the existing remains. Some of the dignity of the columns was due to the massiveness of the diameter compared with the height, which was about eight and a half times the diameter. Nothing now remained above ground except the columns and their architrave, and the upper of the three steps of the stylobate, but underground were sufficient foundations to restore the general plan of the temple, and a few fragments which would assist in a restoration of the superstructure. Previous to the most recent excavations it was generally accepted that the plan was decastyle, but all the beautiful and remarkable *a priori* arguments had been upset by the spade, and the temple proved to have been octastyle. The Society of Dilettanti, with a view to a new edition of the "Principles of Athenian Architecture," desired an examination of the temple, and Mr. Penrose conducted some excavations which commenced in 1883, and were continued at intervals during the three succeeding years. The foundation at the northeast corner was entirely laid bare, and the excavation extended to some way beyond the northwestern angle, a distance of four hundred feet. Mr. Penrose proceeded to give a detailed description of the progress of the work, in the course of which he stated that the level of the pavement below the main stylobate showed that the temple had three steps of equal height. Sufficient evidence of these was obtained near the southeastern angle, and some massive portions of the marble upper step (the two lower were of hard crystalline limestone) displaced, were found on the north side near the eighth column of the north row—one of the confirmations of the octastyle arrangement. Near the fourth column was the foundation of a return wall carefully chased into that which had been laid for the peristyle. This seemed to favor the decastyle theory, but its duty was probably that of a ground buttress to stiffen the pronaos wall. Search was made for a possible ninth and tenth row of columns, but it was clear no preparation had been made for them. The foundations of the seventh row were found to a considerable extent. The foundations of the north cella wall were traced for about eighty feet, and a return wall which fell into it terminated in a door jamb of the principal entrance to the naos.

After describing other portions of the foundations discovered, and referring to the materials used and the dates of their construction, various other parts of the temple were dealt with in considerable detail. Before concluding with a restoration of the temple, Mr. Penrose thought it might be worth while to consider whether a decastyle was first intended, and that reasons of economy had led to the adoption of the octastyle, and deduced reasons to show that this had not been the case. He then described a restoration of the superstructure, based on the excavations, in plan and elevation, which was illustrated with diagrams.

VILLA—PENMAENMAWR BUILDING ESTATE, NORTH WALES—WM. DAWES, ARCH.

A PORTER'S LODGE.

We give, from the *Architectural Era*, a tasteful design for a porter's lodge, at North Andover, Mass. Hartwell & Richardson, architects, Boston, Mass.

House Painting.

Painting, like charity, covers a multitude of sins. The mason who puts down your foundation walls, and, in the hurry of modern custom, forgets the exterior cementing, will, in the most complacent manner, tell the owner or architect to have the inside of the wall painted, to prevent moisture. The cut stone contractor who puts an invisible patch in the corner of a bond stone will tell you to have the surface painted, for the sake of uniform appearance.

The architectural iron worker who neglects to work to his drawings in moulding the columns and beams cares not that they are from a quarter to one-half inch narrower than the plans call for, as long as they contain the requisite weight of iron, for the reason that the painter can fill up the space by using the next larger size plate glass at his own expense, because he has agreed to paint and glaze the building according to plans and specifications; and, by the way, these same specifications contain more combined terror to the average painter than the entire Code Napoleon and the common law of England does. The bricklayer who forgets to fill the spaces between his wall and the door and window frames, in like manner tells you the painter can fill them up with putty; also, the galvanized iron cornice maker, as well as the metal roofer, will economize by leaving their joints unsoldered, because the painter follows after them, and can remedy the defects with putty and paint; and it is still an unsettled question whether the skylight leak is caused by defective glazing, or through the inferior work of the tar and gravel roofer. The inside of a building also bears evidence of the truth of this idea.

The carpenter whose specifications call for first, clear lumber, which cannot be found, uses the next best obtainable quality, and at once, upon its arrival on the ground, wants the very thing of all others which should not be done, the priming to prevent shrinkage, the only thing it needs to make good lumber of it, attended to promptly.

The plumber whose iron pipe, with a connection on either end, has been wrongly measured, will saw it in twain, file it neatly, and set it up, strong in his faith that paint will remedy the defect as far as appearance goes.

The plasterer, the position of whose angles bears a striking resemblance to the leaning tower, whose cornice

A PORTER'S LODGE AT NORTH ANDOVER, MASS.—HARTWELL & RICHARDSON, ARCHITECTS.

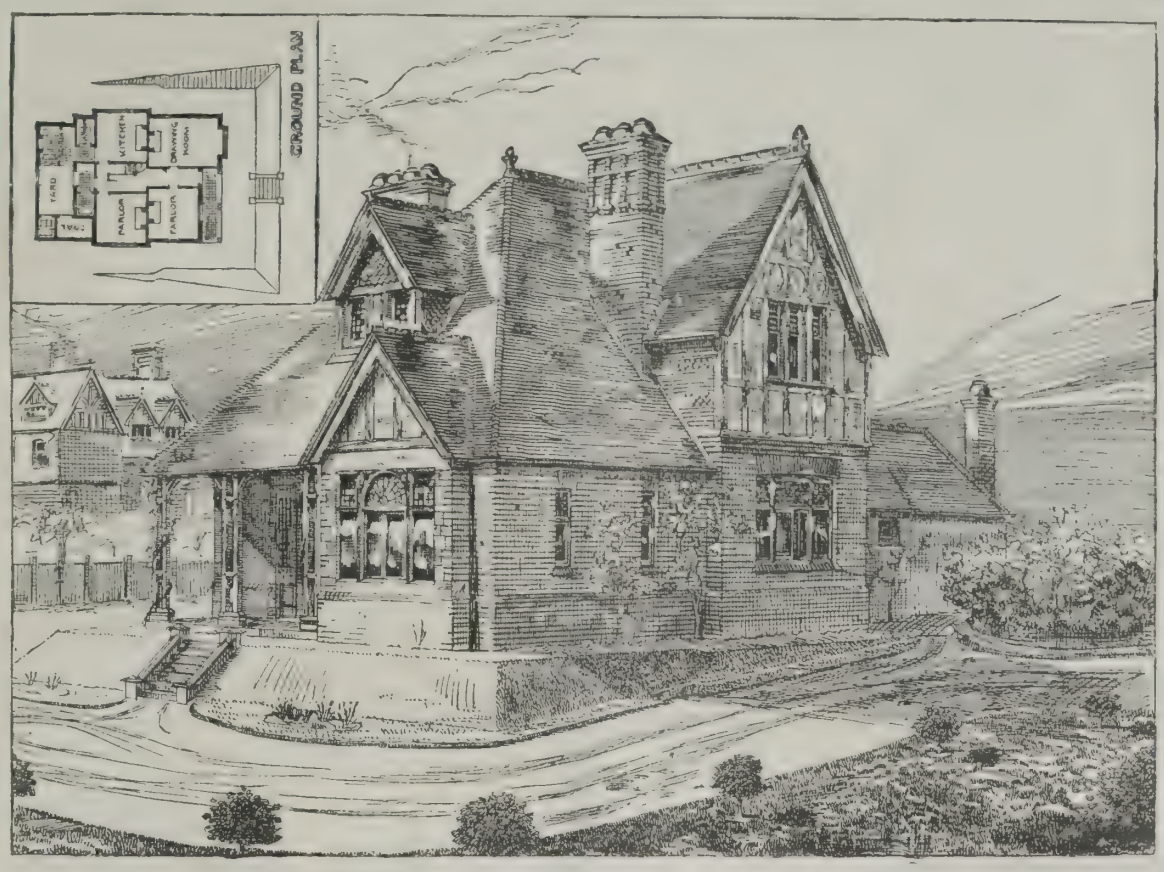
mouldings look like an amateur's painting of a New England rail fence, and whose walls, on having the straight edge applied to them, show spaces large enough to pull the biblical rich man through, will tell you the painter can remedy these slight defects when the decorating is being done. An architect who revels in Grecian domes, Roman columns, Moorish fretwork, and all the other isms and schisms of the profession, undertakes to utilize the entire category in the construction of the twenty-foot front of a suburban villa to be erected, at an expense of $700, for the well known firm of Ten Per Cent & Co., and sold by them on monthly payments of $15 each month; and when all else is arranged for, the architect sits down and writes specifications for the painter about as follows: "All the materials, tools, and appliances necessary to the full and complete performance of the conditions hereinafter set forth must be furnished and supplied by the painter. All interior wood work (floors excepted), of every kind and description, must receive one coat of pure gum shellac, cut in pure alcohol, after which it must have four coats of Skin the Painter & Co.'s best light hard oil finish, brushed on smooth and even, and rubbed thoroughly smooth between each coat, and in the final finish must be rubbed with pumice and oil to a dull, smooth piano finish.

"For the full and complete performance of the foregoing, it is hereby agreed, by and between the parties to this contract, that he (the painter) shall receive the sum of $57 in the lawful money of the United States."

The features of the painting trade most interesting, perhaps, to this convention are the hardest to reach, and much as it may be desired, it will be very difficult to give anything like accurate statistics as to the total number of men employed, rates of wages paid, or the position numerically of the trade in the list of building industries of the country. The best recent figures obtainable place the number of men employed in the house painting trade in New York City at 9,000; number of firms carrying on the business, 733; amount of capital invested, $3,000,000; amount of wages per year, $7,200,000; and average wages, $12 per week of 59 hours. In Chicago there are 300 firms carrying on the business, and they employ about 3,000 men, whose average wages are the same as those in New York City.

Taking these New York and Chicago figures as a basis of computation, in connection with the United States census of 1880, we find that at the present time about 4,000 firms are engaged in the business, with an invested capital of $30,000,000, and employing 100,000 men, whose average wages will be about $500 per year each, or a total of $50,000,000 in wages alone for one year; adding to this about $60,000,000 for material and appliances, we have a total of $110,000,000 per annum, to which may be added $40,000,000 for window glass consumed by the trade; making a grand total of $150,000,000 as the net cost of the painters' annual tribute to the building industries of the country.

This is certainly a sum sufficiently large to justify the public in demanding of the painter such careful and intelligent consideration of these interests as will be commensurate with the expenditure of so large a sum, and it is for this reason that the painter desires to lend his feeble cry, in conjunction with the other building trades and professions, through the instrumentality of this national convention of builders, in endeavoring to bring about a reform of the abuses and questionable acts which are to be met with on every hand by the honest architect and contractor.—*J. G. McCarthy, Abs. Proc. National Association of Builders.*



AN ENGLISH COTTAGE—E. C. POOLE, ARCHITECT.

AN ENGLISH COTTAGE.

The materials for the walls are local red bricks for lower part, and stud work (pitch pine) for the upper part. The roofs are covered with strawberry colored Broseley tiles, and the accommodation provided on ground floor being three parlors, kitchen, scullery, larder, and offices, and four bedrooms on chamber floor. The architect is Mr. E. C. Poole, Southampton.—*Building News.*

THE NEW CONSOLIDATED STOCK AND PETROLEUM EXCHANGE, BROADWAY AND EXCHANGE PLACE, NEW YORK.—[From drawings by E. D. LINDSAY, Architect.]

Sale of Ready Made Plans.

The sale of ready made misfit building plans seems to be increasing, and it has become so profitable that some reputable architects have entered the field, and they at once fall into the ways of the general manufacturer of these designs and quite readily "catch on" to the one feature which makes the business profitable and indeed possible, and that feature is gross misrepresentation as to the cost of building after these plans.

A handsome perspective accompanied by good floor plans, although they may not fit the building at all, with an estimate of cost not much above one-half or two-thirds the actual expenditure required to erect the structure, is no doubt very alluring, and when offered at one-fifth the charges of an architect for apparently the same service, they become positively enchanting to the man who is building a home for somebody else to live in; but when an attempt is made to build after such plans, to fit the various parts together and to keep within estimates, the owner learns to his everlasting sorrow that, like the world in general, he has endeavored to get something for nothing, and failed. Does he deserve sympathy? If an innocent purchaser, yes; if one of that class of people who think the professional man only pretends to know something of his business and gives no other evidence of the possession of unusual knowledge than high charges, the query may be answered in the negative. It is largely the latter class who are the victims of dealers in ready made low-priced plans, but occasionally well-meaning, intelligent men are led to purchase such sketches, and the cost of the mistake becomes really burdensome. The profession of architecture is rapidly advancing in the estimate of the public, but it has yet a good deal to accomplish before it can overcome that all-pervading public desire to get things cheap, and especially to put the artist on a level with the tradesman.

This glance at a great evil would be only a partial view, if we took no notice of one of the many causes for the existence of such evil. Here, as elsewhere, is to be found the law of cause and effect, and while it may be complex, one element, at least, is not to be lost sight of. If the people believe the estimates of architects are unreliable, and to build under their guidance requires useless expenditure or even increased expenditure, they quite naturally look for assistance from whatever source it may be tendered; and at once the ready-made cost-marked plan is forced upon them. It would be false generalization to say that because a good many architects always underestimate the cost of a structure, the entire profession follows such practice; or even because they put more money into a structure than the contracting builder, that architectural advice and guidance are expensive. The truth is, reliable architects always estimate exactly, and they build according to laws from which there can be no safe deviation. Hence the man who wants mere show, at the expense of security and even of comfort, has no use for an architect.—*N. W. Builder.*

THE TOWER OF BABEL.

Among all the scientists of the seventeenth century, he whose imagination was applied to the largest number of objects was perhaps Father Kircher. In the first rank of the singular labors to which he devoted himself figures the reconstruction of the tower of Babel. The great monument that is to commemorate the centenary of 1889 gives a certain character of actuality to these conceptions of the learned Jesuit. We shall present a succinct summary of it.

Kircher, in the book that he wrote upon the subject of the tower of Babel (work in folio, filled with splendid engravings), begins by speculating upon the number of workmen that Nimrod must have had at his disposal when he conceived the idea of erecting this durable sign of the unity of the races. Our author imagines that this prince must have had at his disposal four and a half million laborers. He afterward enumerates the few professions among which they must have been distributed, and the nature of the materials that they must have had to supply themselves with before thinking of piling them up. The chief of these were the sun-hardened bricks which the architects of Mesopotamia still employ for their humble structures, and bitumen, which they use in our day in lieu of cement.

Among the ruins that time has not rendered unrecognizable there is one that the Arabs know under the name of Bisr Nemrod. Although it cannot be identical with the tower of Babel, since it is very distant from the remains of Babylon, it shows very well how these ancient peoples managed to give a great height to their structures, and it consequently justifies the form that Kircher gave to the edifice of which he has left us a description.

According to travelers who have traversed these regions, the base of Bisr Nemrod was a perfectly square platform, 267½ × 267½ feet, which rose to a height of 25½ feet. The same observers teach us that the edifice consisted of a series of platforms similar to the first, but diminishing 35 feet in section at every rise, so as to resemble, as a whole, a gigantic stairway whose steps were 17½ feet in width. Of course, these various platforms communicated by inclined planes or stairways, of which the vestiges have been effaced by time.

In employing such architecture, there could be but seven stories, thus making the total height 154¾ feet, supposing that the interval of the platforms remained the same to the top. According to these same travelers, the height of the four last stories was sensibly less than that of the three first, so that they reduced the height of the structure to less than 134 feet, even in surmounting it with a tabernacle from 12 to 16 feet in height, and consecrated to the adoration of the god in whose honor it was erected.

According to these hypotheses, the summit of Bisr Nemrod rose to a height nearly half that of the Pantheon, and a quarter of that of the Washington monument. With the same system, in order to reach the height of the Eiffel tower, it would have been necessary to start from a base 1,600 or 1,800 feet square, and, consequently, covering more than a quarter of the surface of the Champs de Mars.

The tower of Babel, as Kircher presents it to us (Fig. 2), was constructed according to a less rudimentary process, and exhibited more artistic arrangements, but arrangements that architects of a primitive epoch would have found it difficult to carry out. However, to judge of it by the dimensions that our author gives men and animals, the tower that he represents would have been nearly 1,600 feet in height, although the base did not cover more than two acres. It is true that in order to reach such a result he does not hesitate to give to the first inclined planes a slope that is not practical, since it is at least one to two. Above, he unites the stories by spiral inclined planes, of which he reduces the slope to about one to four, but up which the carriage of material would have been so difficult that Nimrod's builders would certainly have been several times ruined before succeeding in carrying out their contracts.

It is well to note that at a height that may be estimated at a thousand feet, Father Kircher has figured some clouds analogous to those that attach themselves to the sides of mountains. The landscape represents a bird's eye view of a portion of the city of Babylon, where a multitude of edifices constructed in the same way, but upon smaller bases, is represented. In the foreground, and at a great distance from the tower, we see King Nimrod surrounded by his architects, who are showing him the plans of the edifice such as it would have been arranged had not the Biblical catastrophe prevented it from being finished.

In another part of his work, Kircher endeavors to reconstruct the observatory of Babylon according to Herodotus—a structure erected by Ninus and Semiramis, not for the purpose of reaching the sky, but with the very reasonable hope of admiring its wonders better.

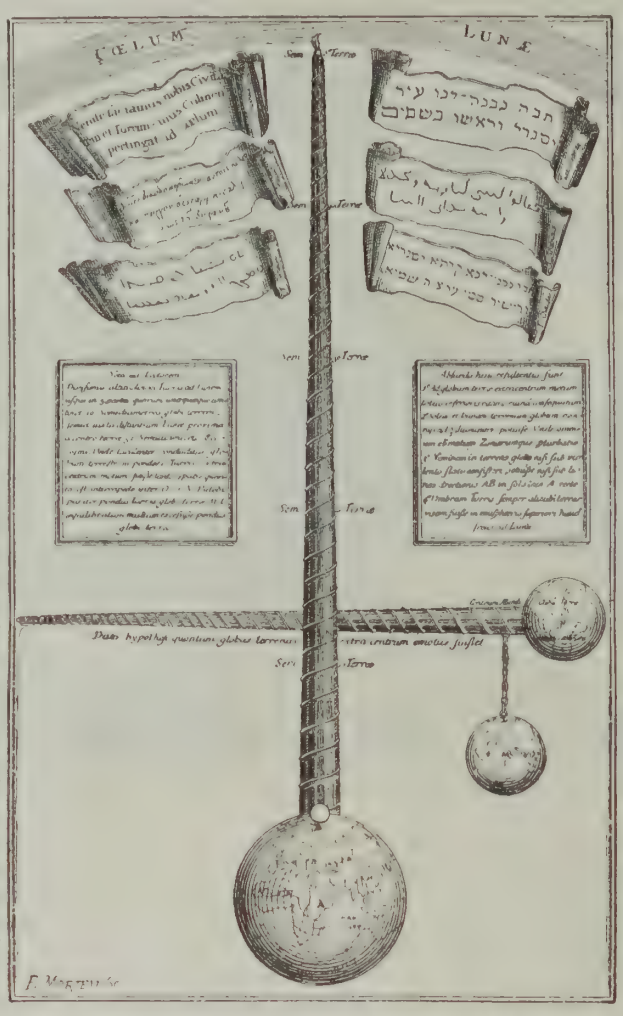


Fig. 1.—SCHEME TO SHOW THAT A TOWER CONSTRUCTED ON THE EARTH CANNOT REACH THE MOON.

Its height would have been 640 feet, and precisely equal to the extent of its basal circumference. It would have been formed of eight superposed towers, each consisting of three stories, diminishing in diameter and terminated by a temple of Belus, in which the astronomers made their observations. Despite the interest that attaches to this tentative, we have not thought it necessary to reproduce in this place the figure that he gives. The most original part of Kircher's work, and that in which he gives most play to his fancy, is where he seriously endeavors to show by a diagram that the idea of carrying the apex of the tower to heaven was an absurdity. In fact, he makes long and minute calculations to establish the fact that it would have been impossible, not only to make it reach the heaven of the fixed stars, but even to carry it to that of the moon, which was the nearest of all, according to the cosmology of the ancients. It would not have been possible to judge of the character of Kircher's work had we not reproduced the plate (Fig. 1) in which the results of these whimsical estimates are summed up and systematized.

In the scrolls that occupy the top of the plate, there is the Biblical legend relative to the convocation of workmen for the construction of the tower of Babel. It is thus conceived: "Come to us and we shall construct a city and a tower whose summit shall reach heaven." This device is written in Latin, Greek, Syriac, Hebrew, Arabic, and Chaldaic.

To the right and left under the devices are seen two square frames containing Latin inscriptions. In the one to the left the author explains that he has divided the ideal tower that surmounts the earth into lengths proportional to the length that he has selected to represent the radius of the earth. It is for this kind of numeration that the figures placed to the right of the diagram of the tower serve. The tower is supposed to approach the lunar heaven at a distance of a terrestrial diameter. Again, this heaven is reduced to the distance of perigee. These precautions are taken so that the moon may not strike the earth in its monthly revolution.

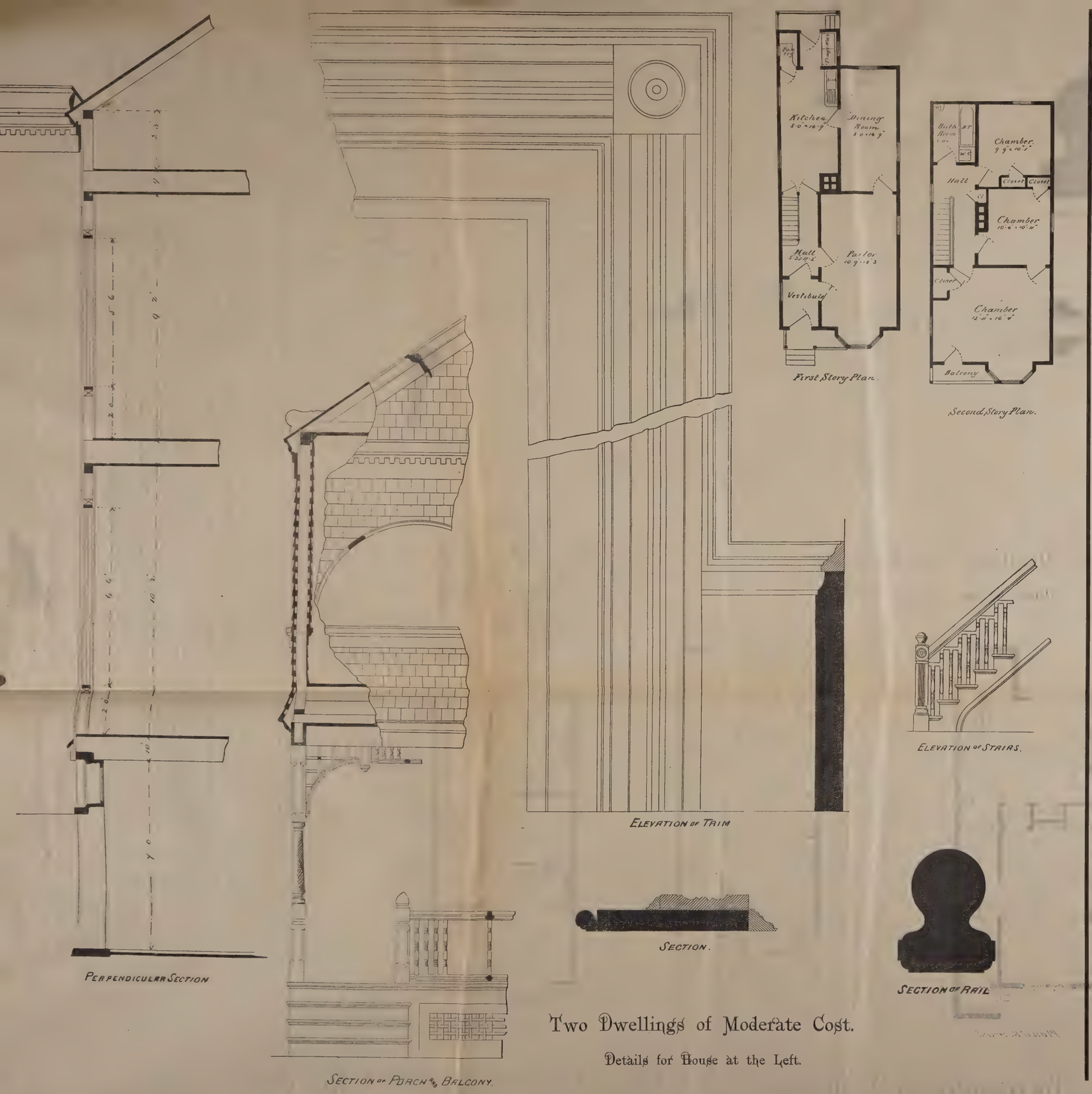
In the frame to the right, there is a legend in which is very succinctly summed up the principal absurdities resulting from the hypothesis that man can erect such a column. The first is that all nature would be subverted, because the center of gravity of the earth would be displaced by a structure of this kind. The figure placed beneath the two frames is designed to develop this thesis, as shown by the legend, of which the following is a translation: "Admitting this hypothesis, how far the globe would be removed from its center."

The globe to the right is represented in its normal situation, and another globe is suspended from it by a chain at the point indicating the new situation. The lower globe shows the earth augmented in radius, in order to prevent the base of the tower, despite the extreme elongation given it by the author, from absorbing the entire globe. It is well to note that Kircher, in other engravings of his book, indicates a southern continent, which occupies a large part of the space where we now know that the Pacific Ocean is situated. The belief in a land on the opposite side of the globe connected with the ancient continent was widespread at this epoch.

In order to establish his fantastic calculations, Kircher starts from an inadmissible hypothesis. In fact, he finds that his column must have a height of 17,867 Italian miles, say 5,840 English miles. Yet he reduces the area of the base to seven miles. The elongation which results from this would be more than two million times. There was never a stick so sharp, and the finest needle is less conical. If we should take up such calculations apropos of the Eiffel tower, and suppose that it was to reach the height of the tower of Nimrod, it would not be difficult to demonstrate that the diameter of a terrestrial hemisphere would not suffice to serve it as a base. We could not dwell upon such details without falling into the error for which not only Kircher has been re-

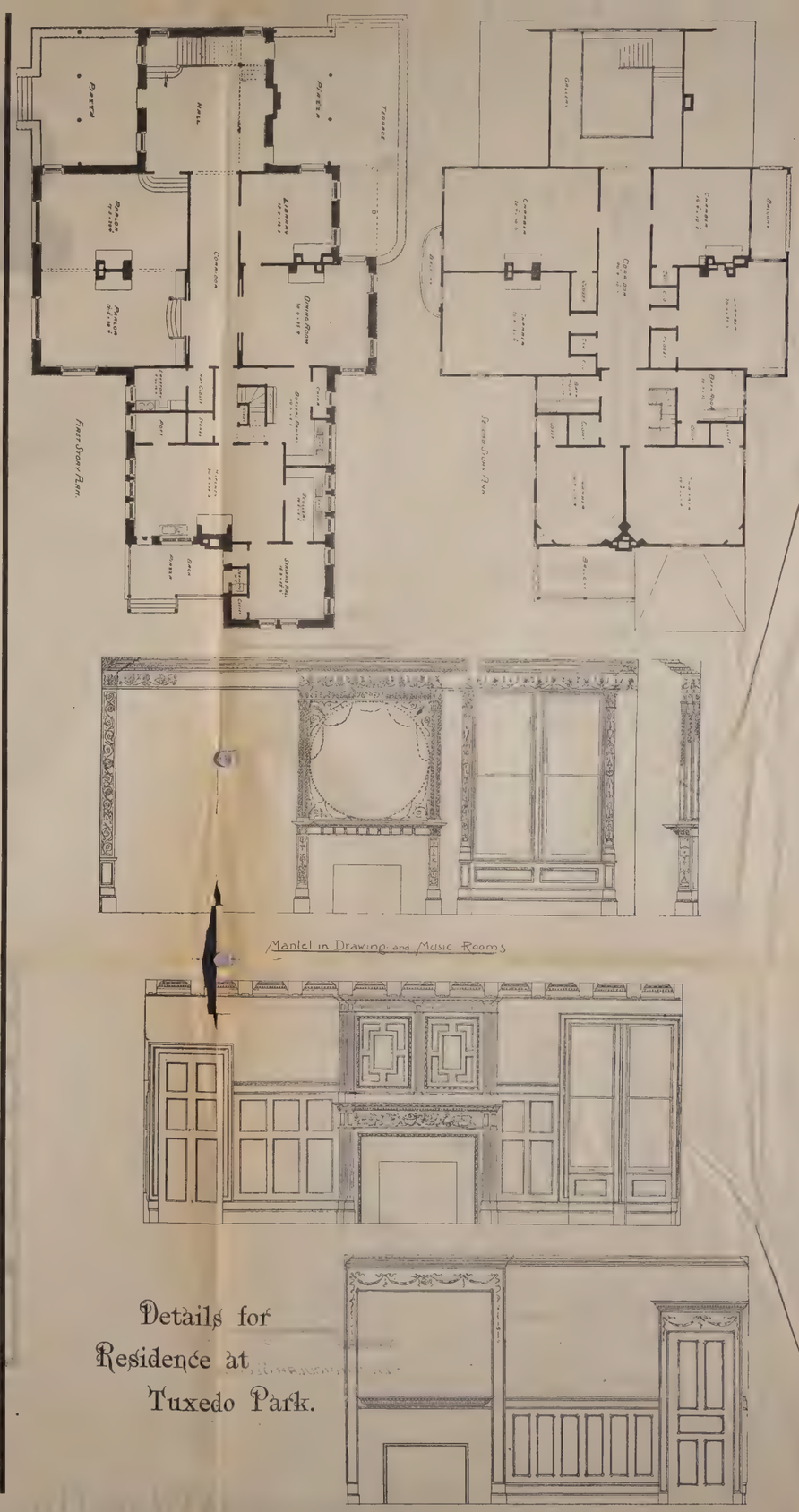
Fig. 2.—THE TOWER OF BABEL, ACCORDING TO FATHER KIRCHER.

· TWO DWELLINGS OF MODERATE COST ·



Two Dwellings of Moderate Cost.

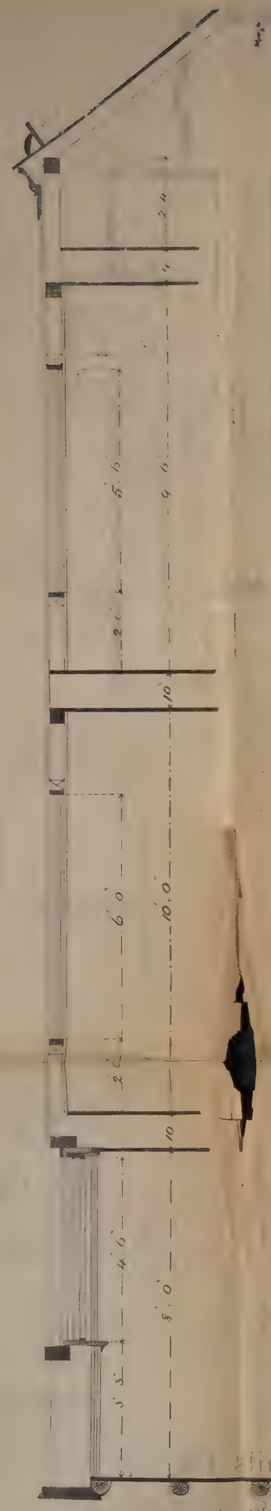
Details for House at the Left.



Details for Residence at Tuxedo Park.

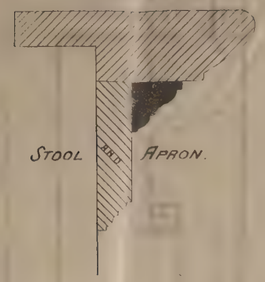
Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for June, 1888.

SECTION OF PORCH & BALCONY.

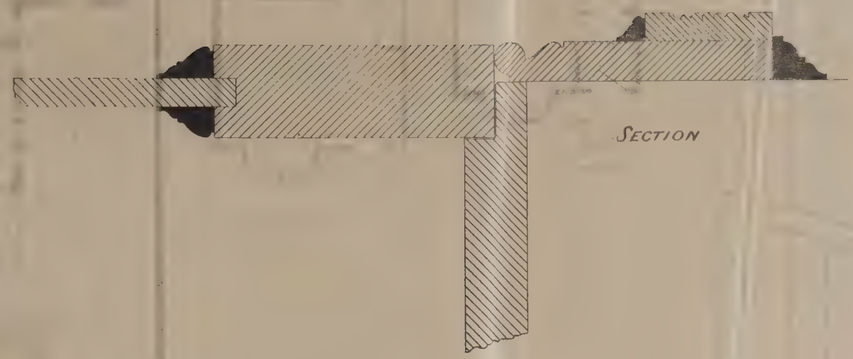


PERPENDICULAR SECTION.

SECTION OF RAIL.



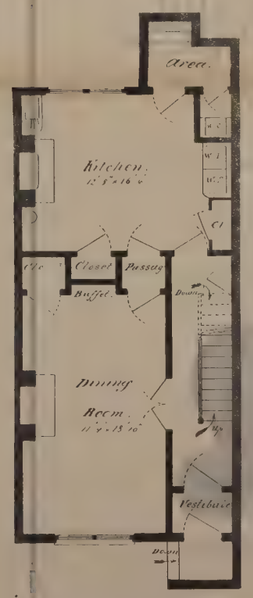
STOOL AND APRON.



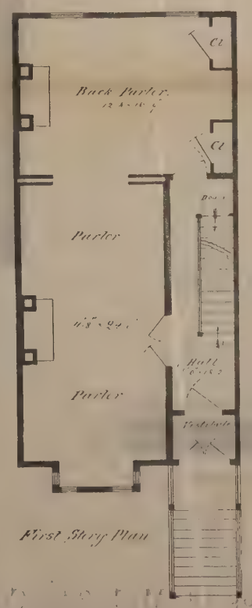
SECTION

Two Dwellings of Moderate Cost.

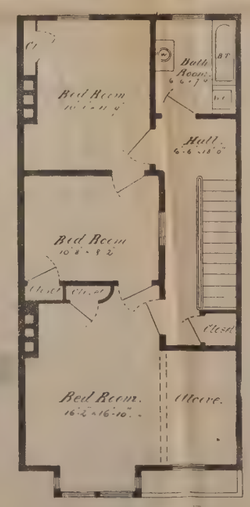
Details for the Basement House.



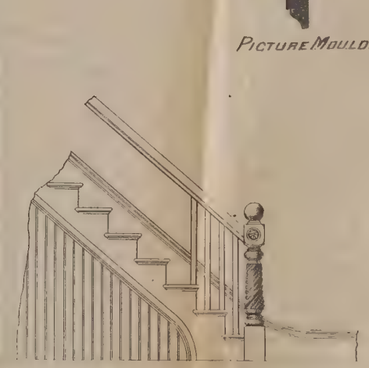
Plan of Basement.



First Story Plan



Second Story Plan



ELEVATION OF STAIRS.

PICTURE MOULDING

ELEVATION OF TRIM

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for June, 1888.

proached, but also many contemporary authors, who carry their calculations way beyond truly reasonable limits, and who, in extending them so far beyond the starting point, deprive them of all sort of sense.

It is not superfluous to add that the work styled *Turris Babel* was printed at Amsterdam in 1679 by Janssen Waesberg, and was dedicated to Leopold I., Emperor of Germany. The permission to print it had been granted at Rome by Father Oliva of the Society of Jesus, and was countersigned by Father Hyacinth, censor of the apostolic palace. The volume, which consists of 232 pages folio, contains a preface in which the author compares the storms of the time in which he lived with the dissensions that followed the confusion of tongues at the destruction of the tower of Babel. What was passing in the profane world was not of a nature to protect Kircher against the melancholy ideas that besieged the old physicist, who had about reached the end of his career at nearly the age of 80. In fact, it was the critical epoch of the history of Germany, in which the Hungarian magnates were endeavoring to support the great lord in order to resist their legitimate sovereign. Although for a long time established at Rome, where he was professor of mathematics at the Roman College, and where he was laden with honors, the celebrated author keenly felt the misfortunes of his country.—*La Nature.*

THE STURTEVANT SYSTEM OF HEATING AND VENTILATING BUILDINGS.

Every architect who has designed buildings of any considerable size has been confronted with the problem

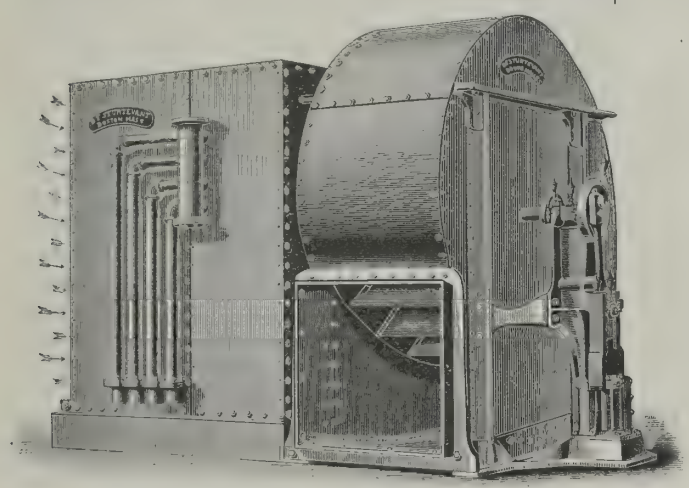


Fig. 1.—STURTEVANT STEAM HOT BLAST APPARATUS.

of how to best heat and ventilate the same. Stoves, furnaces, steam and hot water apparatus are all at his command for the purpose of heating, but for attaining satisfactory ventilation he is too often restricted to natural agencies by the expense which must usually be incurred in adopting other means *in addition* to those employed for heating.

An apparatus which shall do the heating more economically than by other means, while at the same time thoroughly ventilating the space heated, should be thoroughly appreciated by architects. Such an apparatus is that patented and manufactured by B. F. Sturtevant, of Boston, Mass. (so well known as a builder of blowers), shown in Fig. 1, and designated by him as a steam hot blast apparatus. It consists of three combined yet independent parts—a heater, a fan, and an engine. The heater, shown in Fig. 2, consists of a number of hollow cast iron sections, into which are screwed vertical wrought iron pipes, so connecting at the top that when steam is admitted to one end of the section, it is compelled to pass up, over, and down through the pipes, and after condensation is removed by means of a steam trap. The entire heater is incased in a substantial steel plate jacket, thus avoiding all danger from fire. The pipes are set staggering, so that a zigzag course must be taken by the air, which is drawn across them by the action of the fan. The fan is driven at any speed, by the direct connected engine, the exhaust steam from which is completely utilized in the heater. When it is known that the heating power of exhaust steam is but three per cent. less than that of live steam, it will be evident that it costs practically nothing to run the engine, the same steam being used for heating. The entire apparatus can be easily placed in the basement, entirely out of the way.

Leaving the fan, the heated air is forced to all parts of the building through suitable ducts and flues. Convenience and continued economy will be secured by building all vertical flues into the walls, so that there will be no protruding hot air pipes, and so that the registers may be set flush with the walls. The amount of air admitted to each room may be regulated by the occupants of the room by means of the registers; while the general distribution and temperature throughout the building is under the complete control of the janitor or engineer. One of the greatest objections to a furnace system of heating is that the only way to lower the temperature of a room is to reduce the amount of heated air admitted to it; but, by this system of forced circulation, the amount of steam admitted to the heater governs the temperature of the air, while in no way affecting its quantity.

The manner of distribution of the air within the building is dependent to a great extent upon its construction. In some cases, with warm inner and cold outer walls, the air may be admitted and removed through independent registers in the same side of the room. This is particularly adaptable to office buildings. In halls of audience, which usually have all the walls equally exposed, and often all of them inner walls surrounded by corridors, the distribution must be more symmetrically arranged. In such cases, particularly in opera houses, theaters, legislative chambers, etc., where the seats are fixed and arranged upon the amphitheater plan, the air can be admitted at the angle of the risers and treads and beneath the seats, so as to individually ventilate the occupants.

Manufacturing establishments require only a very simple arrangement, and where flues are not provided in the walls, the air may be distributed by metallic pipes running either centrally or around the sides of the building, dependent upon its size and width.

Many architects, after experimenting with natural draught and finding that it was entirely unreliable, have adopted fans for ventilating, but generally as separate from the heating system. The combination of the two in the Sturtevant apparatus not only reduces the expense required to maintain the two independently, but greatly decreases the cost of the plant. Instead of having steam pipes with numerous valves scattered over the building, as required in a direct steam heating plant, the entire heating surface of the Sturtevant apparatus is combined in a single heater, in connection with a fan, and the air is distributed through the flues, which cost nothing, being simply spaces left within the walls. All danger from fire, leaking and freezing is avoided, and the whole system is kept completely under control by a few valves, all near the heater, within a few feet of each other, and easily manipulated. The large amount of air brought in contact with the heating surface by means of the fan raises the efficiency of that surface to such a point that only one-third to one-fifth of the amount of pipe is required in the Sturtevant system that would be necessary to do the same amount of heating by any other system. Above all, in the Sturtevant system a *positive* circulation of warm air is maintained at all times, and in no way affected by changes in the temperature or in the direction and force of the wind.

Thousands of the Sturtevant apparatus have been sold during the past twenty-five years, and hundreds of large and important buildings throughout the country have the system in use. Mr. Sturtevant has just issued a handsome illustrated treatise on the subject of ventilation and heating, illustrating his apparatus and its different arrangements in buildings of all classes. It will be mailed to responsible parties on receipt of address and business card.

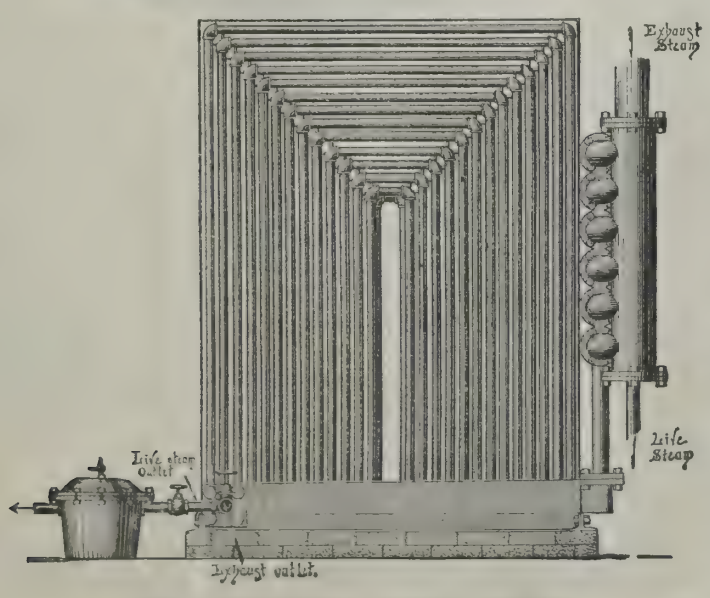


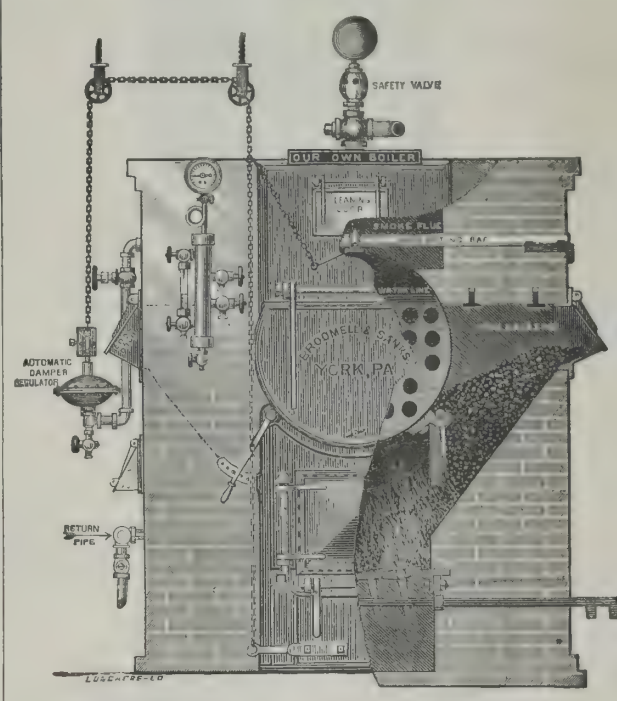
Fig. 2.—STURTEVANT STEAM HEATER.

Gypsum Paint.

The gypsum paint made by Messrs. John Maxwell & Co., of 1603 Otsego Street, Philadelphia, Pa., has much to recommend it for any one having use for such material as kalsomine, cheap paint, or common lime. It is a beautiful and durable article, which does not rub, peel, crack, wash off, or change color, its superiority over lime being like that of paint. Besides white, this gypsum paint is also furnished in the following tints: Pink, French gray, lilac, chocolate, blue, yellow, and pearl. Where these paints cannot be obtained of an agent in the business, the firm provides means of furnishing sample packages or filling orders direct.

A NEW BOILER FOR STEAM OR HOT WATER HEATING.

The accompanying illustration shows an improved heating boiler, equally adapted for steam heating, hot water circulation, or power purposes, manufactured by Messrs. Broomell & Sanks, of York, Pa. The brickwork is partially cut away to give a front view and show the coal magazine, there being two coal pockets, one on each side. These side feed coal magazines will carry sufficient fuel to keep steam constantly for forty-eight hours, there being check doors by which the flow of coal can be regulated to a nicety or can be stopped altogether, while the door is very large, and available

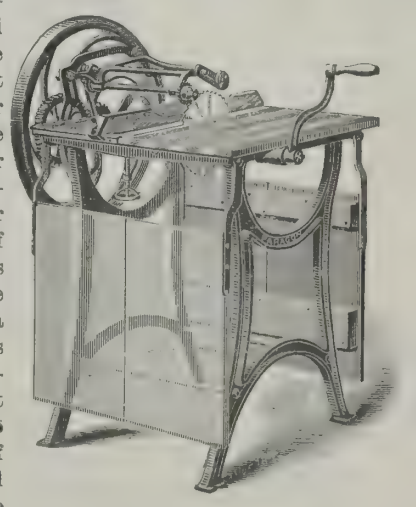


FRONT VIEW, WITH BRICKWORK PARTIALLY CUT AWAY TO SHOW COAL MAGAZINE, ETC.

for cleaning the fire as well as for putting on coal. An extra vertical grate is furnished with the boiler, which goes in when using the magazine, to prevent coal from falling out at the front when the door is opened. The boilers hold a large amount of water, and when once hot retain their heat for a long time, affording a great advantage over boilers holding only a small amount of water, while they will make steam with a small quantity of fuel. These boilers are made of the best quality steel and wrought iron boiler plate, warranted to be safe at one hundred pounds pressure, and fitted with every known appliance to assure security and ease of management.

THE PARAGON SELF-FEED RIP SAW.

The saw shown in the accompanying illustration is a new hand power machine made by the Seneca Falls Manufacturing Company, of Seneca Falls, N. Y., and designed for carpenters, builders, and all woodworkers who desire to do ripping, grooving, etc. It has a self-adjusting feed, and is positive in its action, the feed having three changes of speed, fast, medium, and slow, for various kinds of work. The table is of hard wood, with an adjustable gauge, and hinged at the back, so that it can be raised or lowered by the hand screw for grooving, rabbeting, etc., while for ripping long stuff it has drop leaves which may be raised, making a long table. This machine is designed to easily cut soft wood up to three and a half inches and hard wood up to two inches thick, doing the work of from four to six men with the common hand saw. If desired, a pulley can be attached to the driving shaft in place of the balance wheel, for steam power.



The Mason Regulator Company, of Boston, Mass.,

have issued a new circular, which they will mail to any one interested, describing their manufactures of reducing valves, steam pump pressure regulators and governors, balanced and lever valves, steam traps, diaphragm valves for electric heat regulating devices, etc. The company make a variety of devices in this line which are now largely used and have the highest indorsement of the engineering profession.

THE HUMPHREY PONY HAND ELEVATOR.

The Edward Storm Spring Company, of Poughkeepsie, N. Y., who recently introduced the New York Safety Dumb Waiter with so much success, have perfected and are now manufacturing this excellent hand elevator, which has a carrying capacity of 500 pounds, and will be found of great use for light store and factory work, hospitals and public buildings, and for the various duties required of an elevator in tenements, flats, and private dwellings.

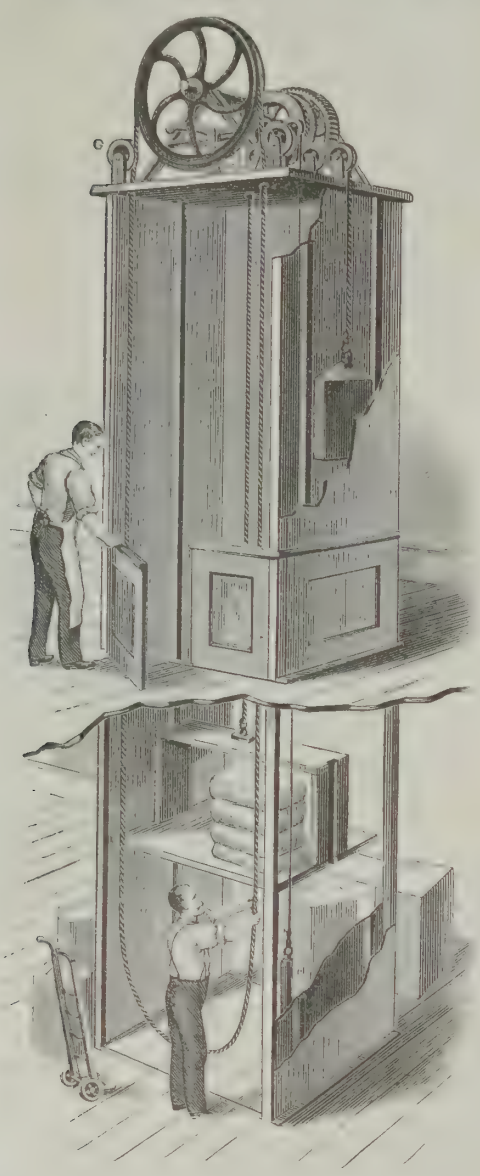


Fig. 1.—THE HUMPHREY PONY HAND ELEVATOR.

It is so simple in construction and is furnished at such a moderate price that it can be used in many places instead of a dumb waiter, and has many times its lifting capacity.

We give two views, showing the elevator complete and in operation, and an enlarged view of the brake attachment.

Fig. 1 shows the fixtures adjusted on top shelf of well hole, also the opening on ground floor. The weight can be adjusted to run down on either the right or left hand side, as desired, and the fixtures are supplied either way as required, where so stated in the order. The small guide wheels, G G, can be moved to draw in or spread out the hoist rope to fit the opening of the well hole. The weight, H, is attached to the bottom of the brake rope, and raising or pulling on this rope relieves or applies the brakes. For hoist rope use ¾ manila rope; for lifting rope use either ¾ manila or ½ inch wire tiller rope. The latter is preferable.

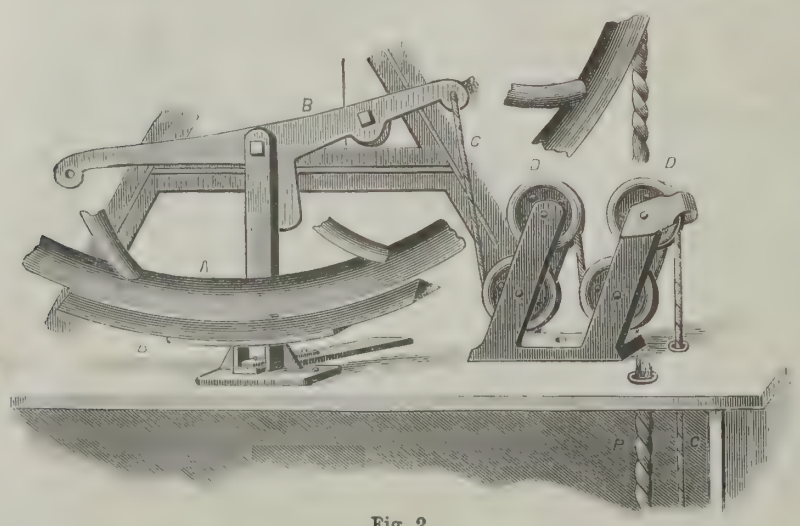


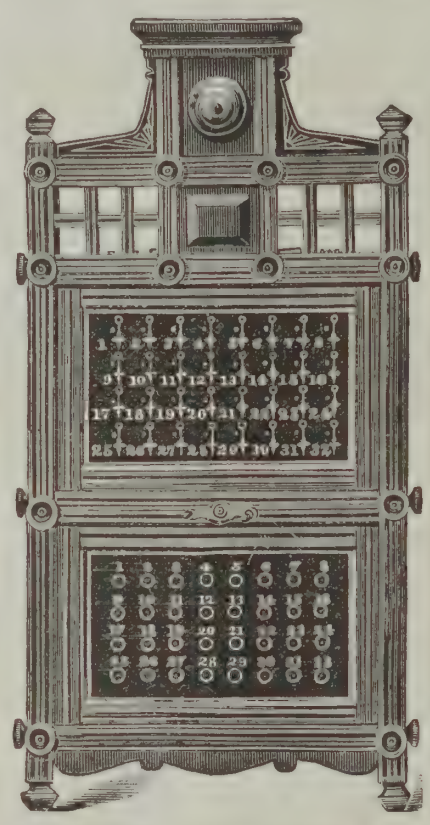
Fig. 2.

Fig. 2 shows more plainly the brake attachment; B shows the lever and hardwood shoe attached, and the manner in which it is bolted to frame of fixtures; C C shows the brake cord passing up through shelf and over the friction wheels, D D, and fastened to brake lever.

Fully illustrated pamphlet will be sent on application, and all interested should address the manufacturers.

ELECTRICAL SUPPLIES.

The return call system of annunciators, illustrated herewith, manufactured by Messrs. Partrick & Carter, of Philadelphia, have been proved to be so great a convenience that they have been introduced in large numbers. This return or guest call system is composed of an annunciator for office, but having a series of push buttons attached in the same case. All connections are made inside the case, so that only the ordinary number of washers for wires appear on top of the case where the connections to the room wires are made. The same wire answers for a circuit from room to annunciator and from push on annunciator to the bell in the room. Only one extra wire from the battery is used, one branch of connecting wire from it being taken into each room. Five cells of battery are used for the annunciator and the return call circuit, an open and closed circuit push being used in the rooms. In case of fire the guests can be alarmed by pressing the push at the annunciator, pressing two to five of these pushes at once. This device answers for a small hotel, avoiding the expense of a combined guest call and fire alarm system, with which many additional cells of battery would have to be used. Messrs. Partrick & Carter are manufacturers of hotel and house annunciators, burglar alarms, bells, batteries, etc., and a full line of supplies for electric bell work.



ANNUNCIATOR, WITH RETURN CALL.

Permanency of Color in Paint.

Art is tributary to art, and more especially has it become so at the present day. The crude appliances of the workmen who painted the walls of the Egyptian temples upward of forty centuries ago would be valueless to the painter and decorator of the present time, and yet the pigments employed in ancient Egypt possessed qualities in respect to permanency of color unknown to the modern painter, and which even our best color makers might well consider one of the lost arts. It must be admitted by practical house painters and others who give the subject careful study that there has been less advancement in the art of decorative and preservative painting, so far as materials and their preparations are concerned, than in any other class of handicraft. Especially is this the case with outside paints, of which linseed oil and white lead form the principal part.

The prevailing style of painting the exterior of buildings in various tints has made the manufacture and preparation of house paints a separate art in itself, and an intimate knowledge of the different coloring pigments, and accuracy of proportion required to produce uniformity in the many shades employed and harmony of colors, partakes in these days more of the chemist's than the mechanic's skill. The average painter would no more think of grinding his own colors than he would of corroding the lead he uses.

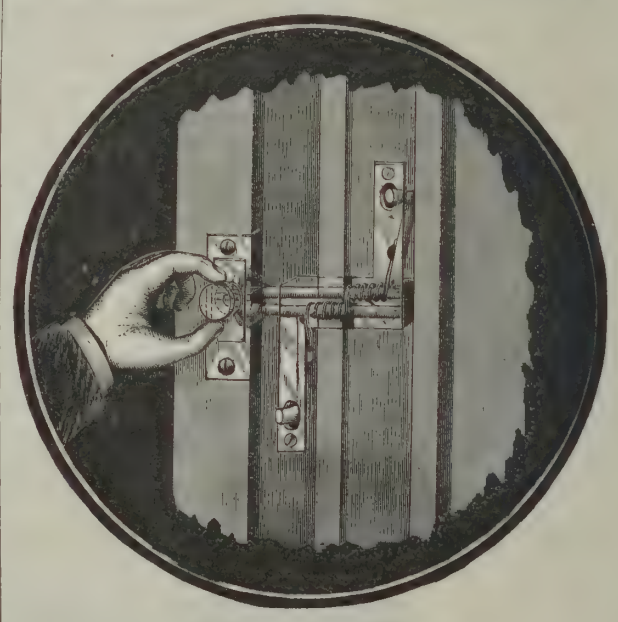
One not infrequently hears painters and other persons condemn in general terms the so called ready mixed paints as unfit to use, notwithstanding the fact that the sale of these goods is constantly increasing. The great convenience of the prepared paints is a reason for the growth of the business, notwithstanding the fact that a large proportion of all that are made and sold are really of inferior quality. The manufacturers of the U. S. Gutta Percha Paint, of Providence, R. I., claim to be an exception to the almost universal rule among paint manufacturers, in that they make an article, as they assert, which conforms to the best known and generally accepted ideas among practical painters and scientific men as to what constitutes a perfectly reliable paint. This company will be glad to correspond with architects, painters, real estate owners and improvers in reference to their goods, and hold themselves in readiness to demonstrate the superiority of their manufactures. They have recently gotten out a little book on "Paints and Methods of Manufacture," which they will send gratis to any person who applies. They also claim to have perfected an oil, to which they give the name of "H. P. Restorative Oil," for coating over exterior painted surfaces which do not need any more pigment, but do require oil to freshen and restore the colors which have faded. The oil is also remarkably adapted for coating over stained shingles and hard wood or grained outside doors.

Mineral Wool.

The uses of mineral wool in architecture, car building, and steam engineering form the subject of a most interesting pamphlet just issued by the Western Mineral Wool Company, of Cleveland, Ohio, manufacturers of mineral wool in bulk and sectional coverings for steam pipes and boilers. The resemblance of mineral wool to the fibers of wool or cotton is what gives the article its name, although it is a vitreous substance of fine fibers interlacing each other, forming an innumerable number of minute air cells. It partakes of the nature of glass, but is without its brittleness, the fibers being soft, pliant, and inelastic. By an improved process of manufacture, the Western Mineral Wool Co. are now producing an article of greatly improved strength, lightness, and freedom from dross. As an insulator, for pipe and boiler coverings, as a protection against frost, and as a protection against rats, mice, and insects, mineral wool has hardly an equal.

A BURGLAR-PROOF SASH LOCK AND VENTILATOR.

The device shown in the accompanying illustration, manufactured by Messrs Jenkins & Timby, of Oswego, N. Y., is made of the best malleable iron, steel, brass, and bronze metal. It locks either one or both of the sash securely in any position desired, thereby affording the means of securing perfect ventilation, while it is absolutely secure against burglars and sneak thieves.



TIMBY'S SASH LOCK.

It is simple and automatic in its action, while possessing great strength. It is designed to be set into the window frame, the center of the lock in line with the center of the meeting rails of the sash, and is operated by means of a sliding thumb nut on a face plate attached to the inside stop. A locking device in the thumb nut prevents the possibility of manipulating the lock from the outside when the window is open for ventilation. The lock adjusts itself to varying thicknesses of sash or inside stops, and does not interfere with applying weather strips or inside blinds The circular of the manufacturers gives full and explicit directions for applying and operating this lock, so that no difficulty need be experienced in attaching it.

The greatest whirlpool is the Maelstrom, southwest of the Loffoden Isles, off the coast of Norway. It is produced by the meeting of two opposing currents, and is one and one-half miles in diameter.

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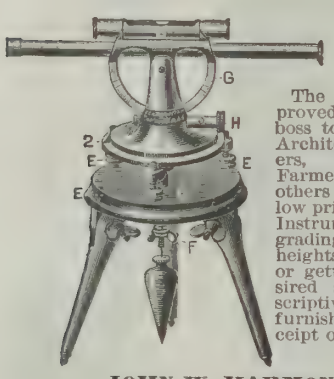

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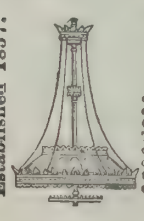

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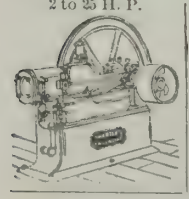

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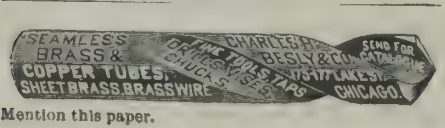

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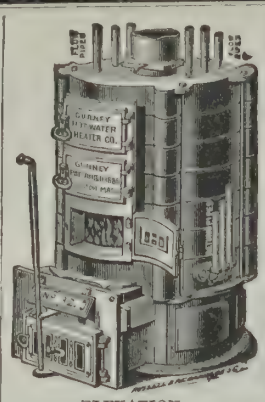

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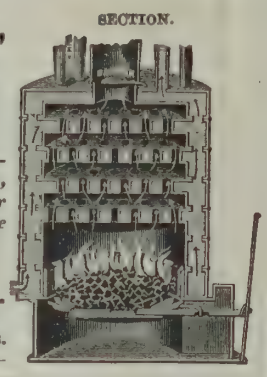

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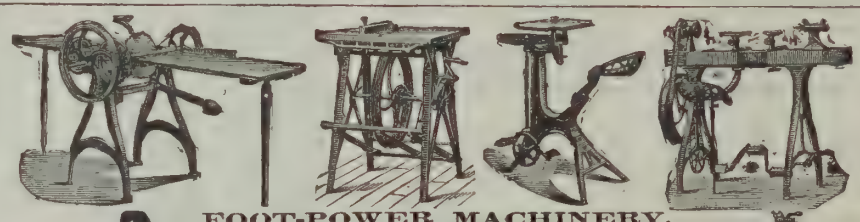

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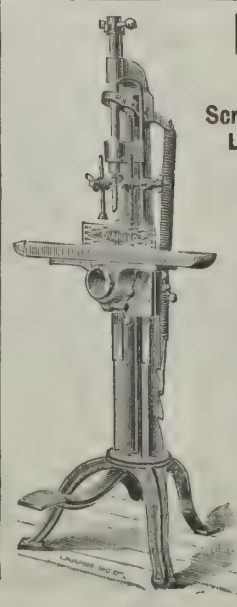

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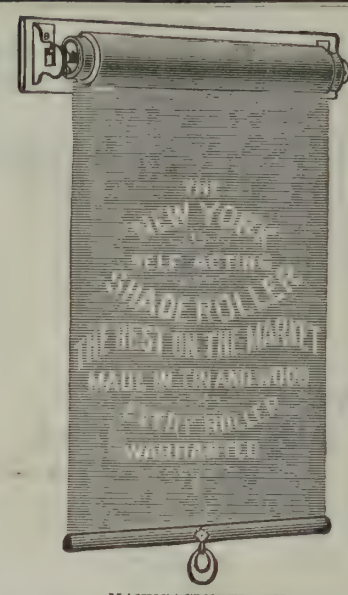

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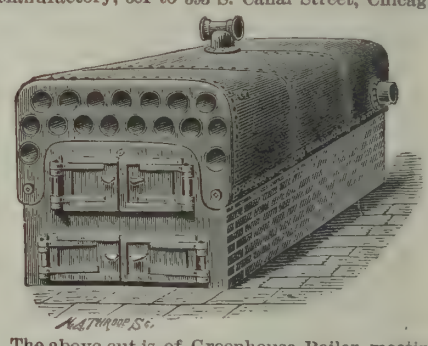

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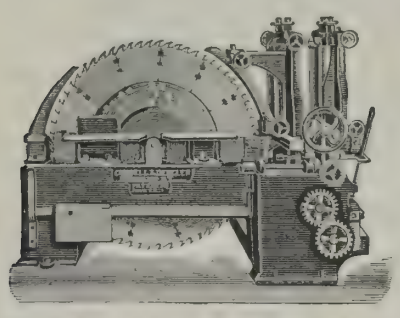

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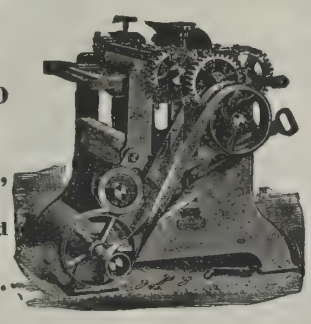

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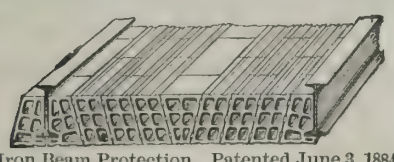

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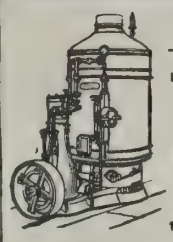

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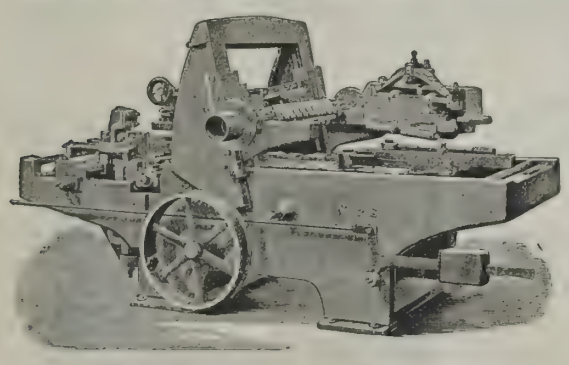

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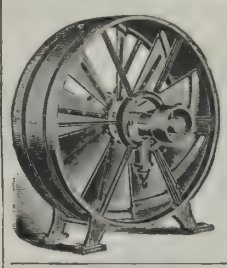

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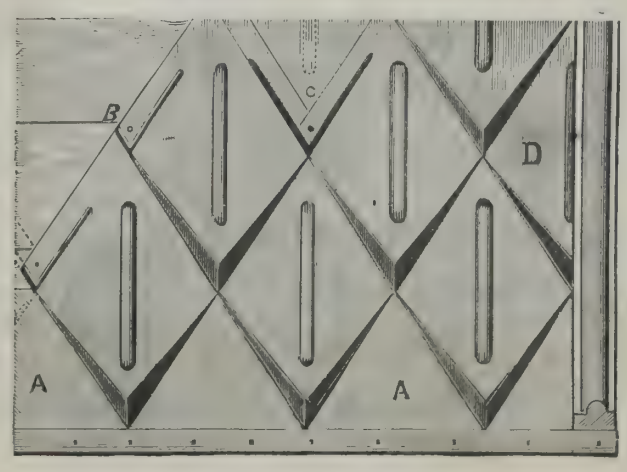

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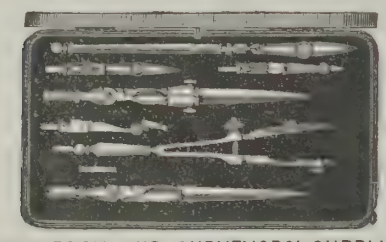

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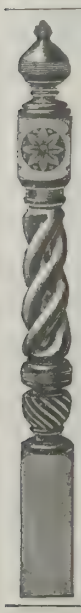

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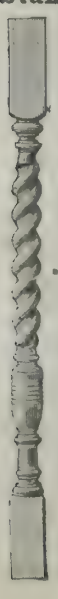

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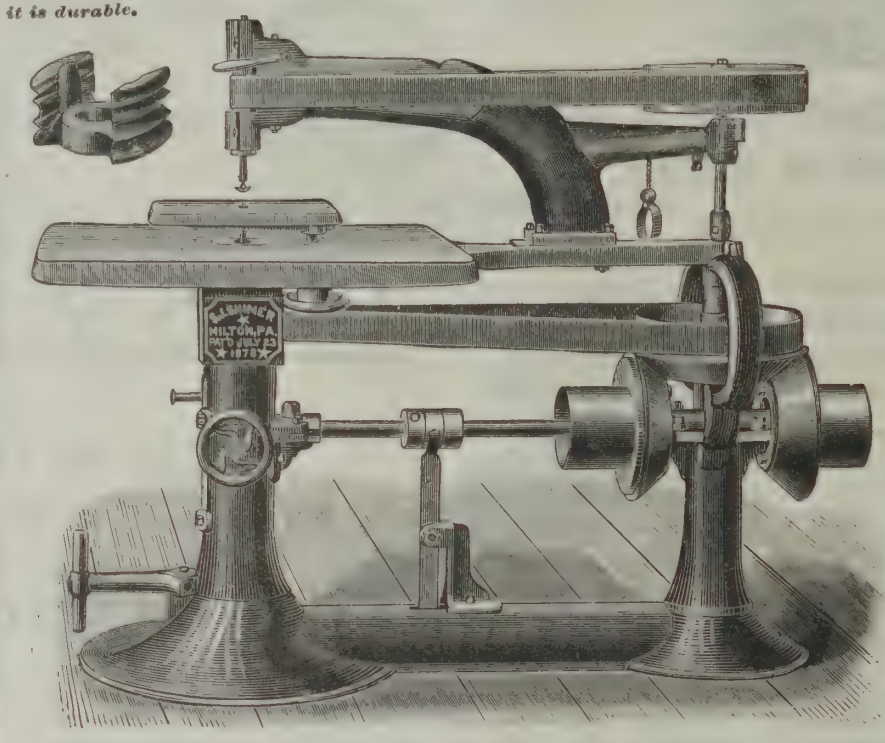

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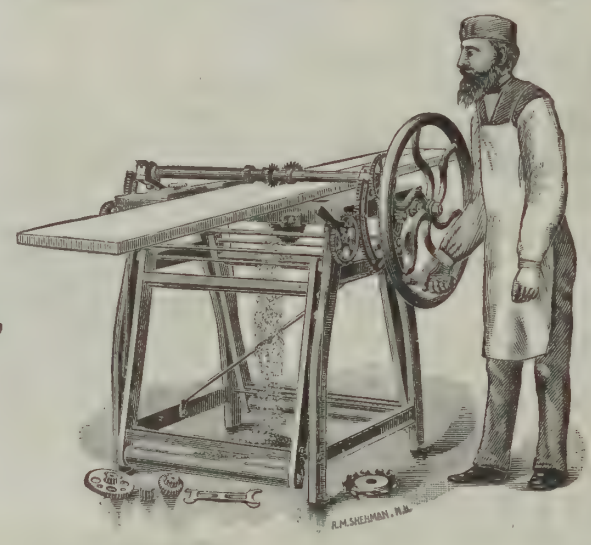

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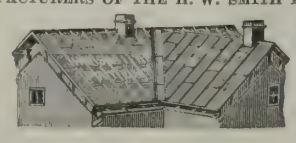

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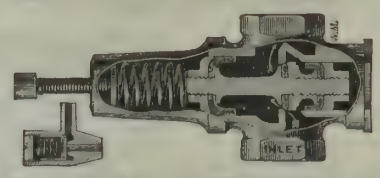

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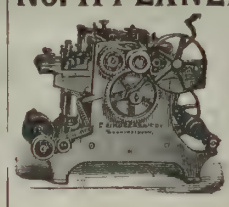

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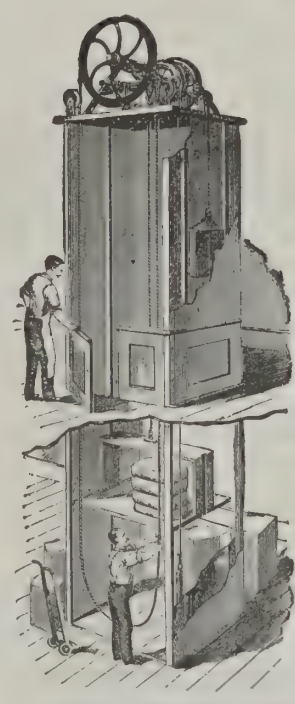

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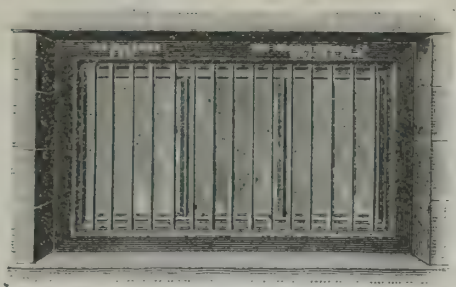

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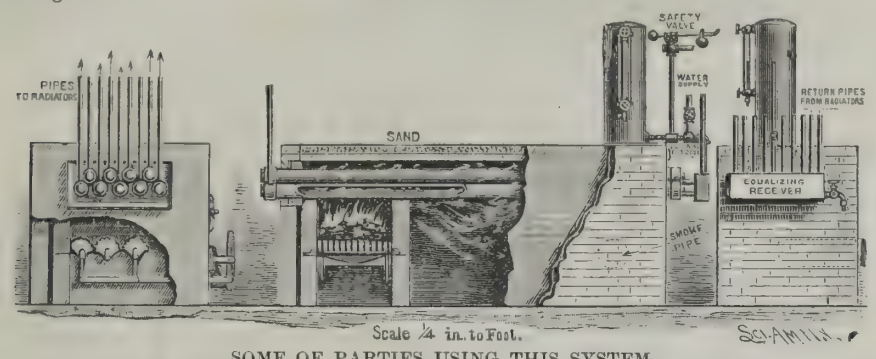

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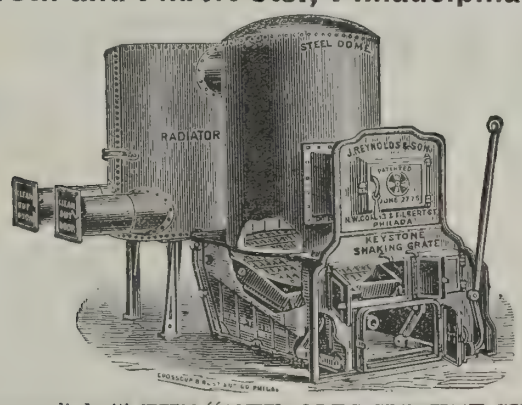

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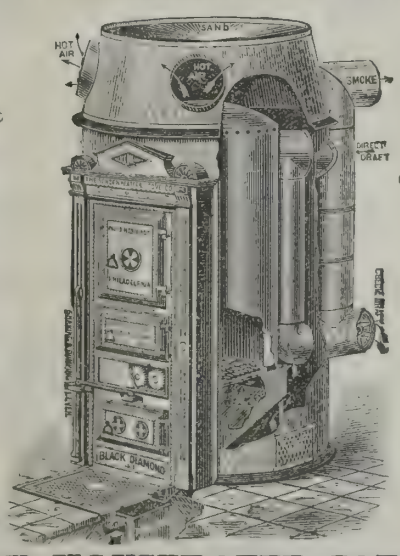

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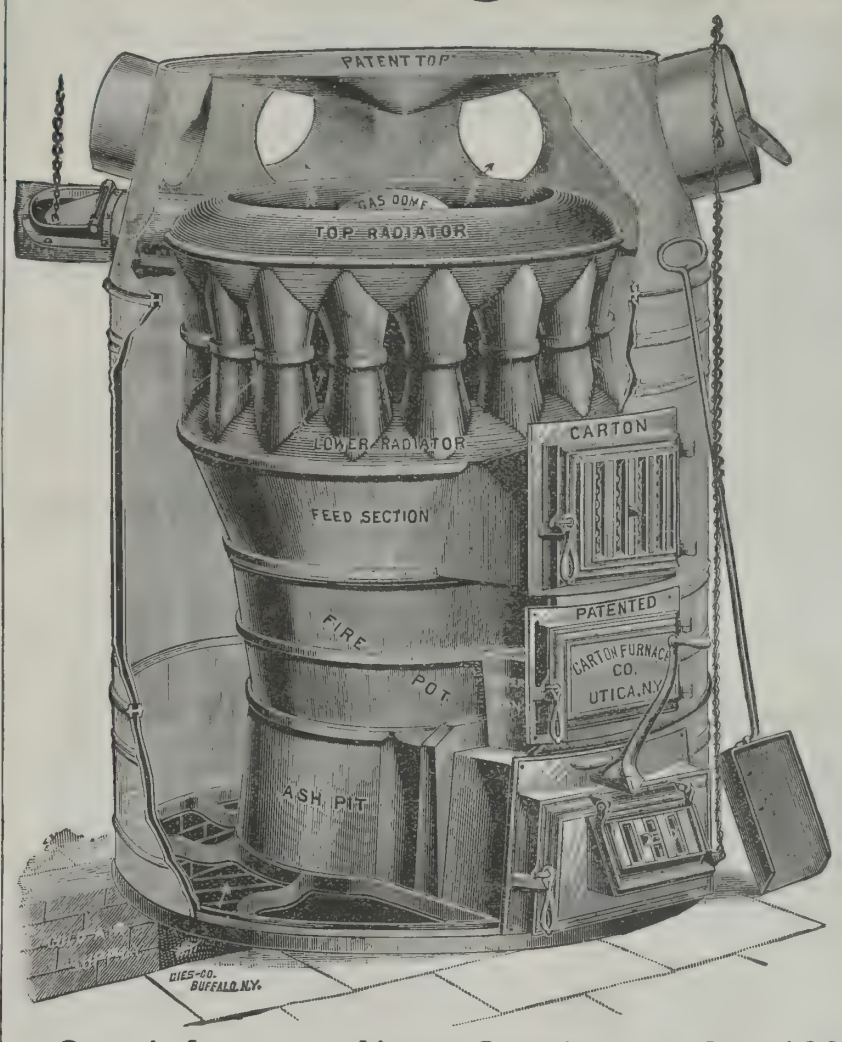

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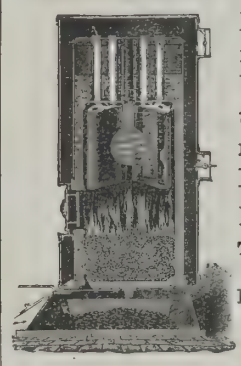

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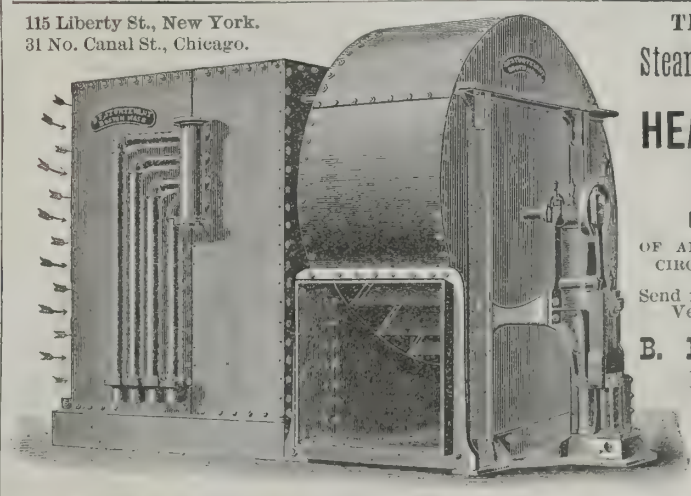

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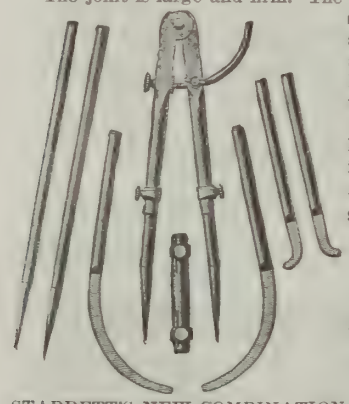

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Combination Squares, Caliper Squares, Bevel Protractors, Thread Gauges, Steel Rules, Surface Gauges, Scratch Gauges, &c., &c.

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Estimates furnished (under new construction) for

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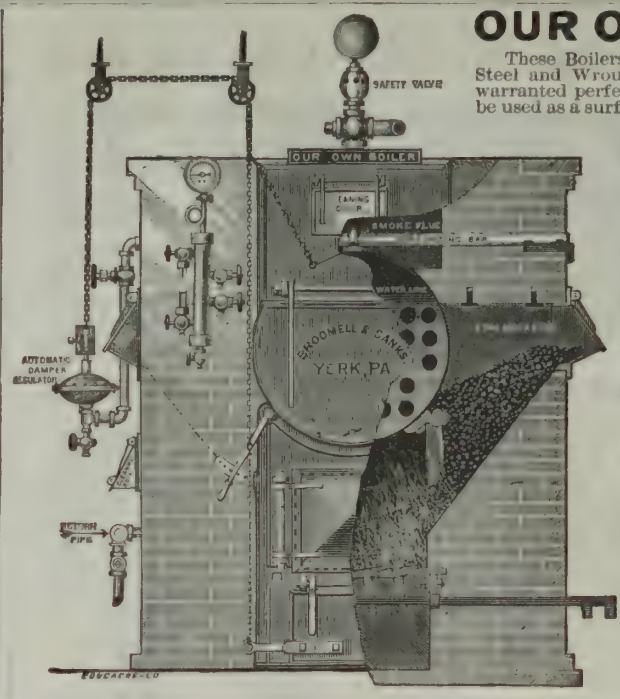

These Boilers are made of the best quality of Steel and Wrought Iron Boiler Plate, and are warranted perfectly safe at 100 lb. pressure. Can be used as a surface burner or Magazine Boiler, as desired. Magazines will hold sufficient coal to keep up steam for 48 hours.

Particular attention is called to the arrangement of check doors in the magazines by which THE FLOW OF COAL CAN BE REGULATED to a nicety, or can be prevented entirely.

It is impossible to use any magazine boiler successfully except by the aid of these check doors, of which we are the exclusive owners.

We make an exclusive business of Steam and Hot Water Heating, and the manufacture of

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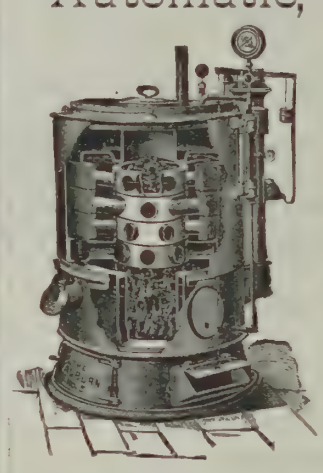
"THE AUBURN" STEAM HEATING BOILERS,

Automatic, Self-Feeding, Portable.



Requires attention but once in from twelve to twenty-four hours. Fuel magazine surrounded by water. Self-locking shaking grate. Waste of coal *impossible. No dust. No gas.*

The Woodcock Patent Shaking Grate, For Boiler Furnaces of all Descriptions

Saves its cost in a year, supplanting all other shaking grates. No waste of coal. No burnt or broken grates. Self-locking, and as nearly automatic as a grate can be made.

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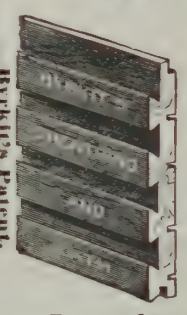
HOW TO BUILD A PERFECT HOME WITH VERY LITTLE COST.



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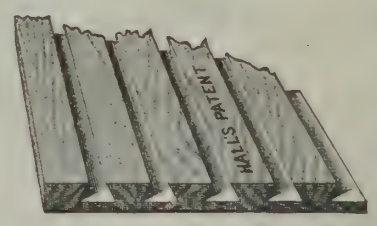
USE COMBINED SHEATHING LATH.



Hall's Patent.

It makes a cheaper, warmer and stronger house than brick or stone. It is a dry and therefore a healthy house. The plaster will not crack. Architects and Builders specify it all over the country.

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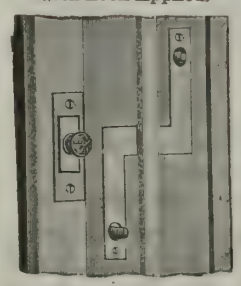
Timby's Burglar-Proof Sash Lock and Ventilator.

Patented March 29, 1887.

Manufactured from the Best Malleable Iron, Steel, Brass and Bronze Metal.

Fig. 1.—Section of Frame with Lock Applied.



Thumb Nut moved upward, releasing upper sash.

Is very simple in construction, strong and durable, absolutely **Burglar-Proof**, and a perfect Ventilator; automatic in action, easily applied to any window, as it adjusts itself to varying thicknesses of sash or inside stops.

Only One Lock is Required for a Window,

as it controls both sash perfectly, bolting either or both securely in any position desired, thereby affording means for perfect ventilation, and at the same time absolute security against burglars and sneak thieves. It is easily operated, ornamental in appearance, and does not interfere with applying weather strips or inside blinds. It is just as important that each and every window should be provided with a good, substantial lock as that the front door should be. *Buy the Timby Burglar-Proof, and take no other.* The convenience and absolute security afforded will be ample reward. Full directions and pattern for setting accompany each lock.

For Price-List and further information, apply to

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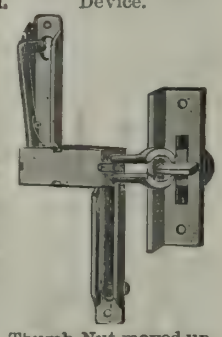
Fig. 2.—Back View of Lock and Operating Device.

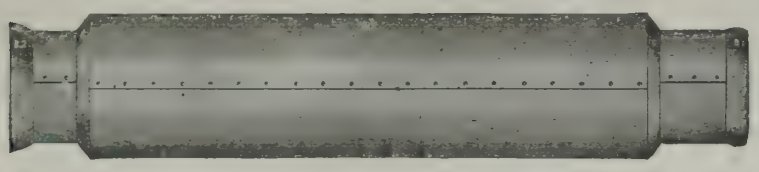


Thumb Nut moved upward and bolt thrown back, same as in Fig. 1.

WROUGHT IRON AND CEMENT LINED PIPE.

This pipe is especially adapted for Water, Gas, and Sanitary purposes.

The construction of the pipe giving it STRENGTH, DURABILITY, and PURITY, and is impervious. Will not ENCRUST or CORRODE.



Pipe complete and ready for the trench.

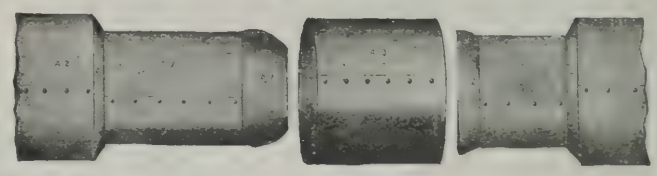
It is designed for

Public Works,

Public Buildings,

—AND—

Private Dwellings.



Wrought iron sleeve and the male and female ends before connecting for jointing.

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PENNSYLVANIA PIPE MANUFACTURING CO.,

Germantown Junction, Philadelphia, Pa.

PANCOAST & ROGERS,

GENERAL AGENTS FOR

READING IRON WORKS, Wrought Iron Pipe, Boiler Tubes, Artesian and Oil Well Tubing, Casing, Line Pipe, etc. Special work of every kind in Wrought Iron.

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THE WATERBURY MALLEABLE IRON CO. Malleable and Gray Iron Fittings for Gas, Steam, and Water.

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HALF SIZE.

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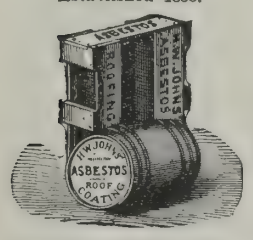

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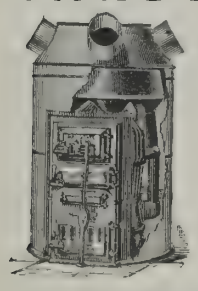

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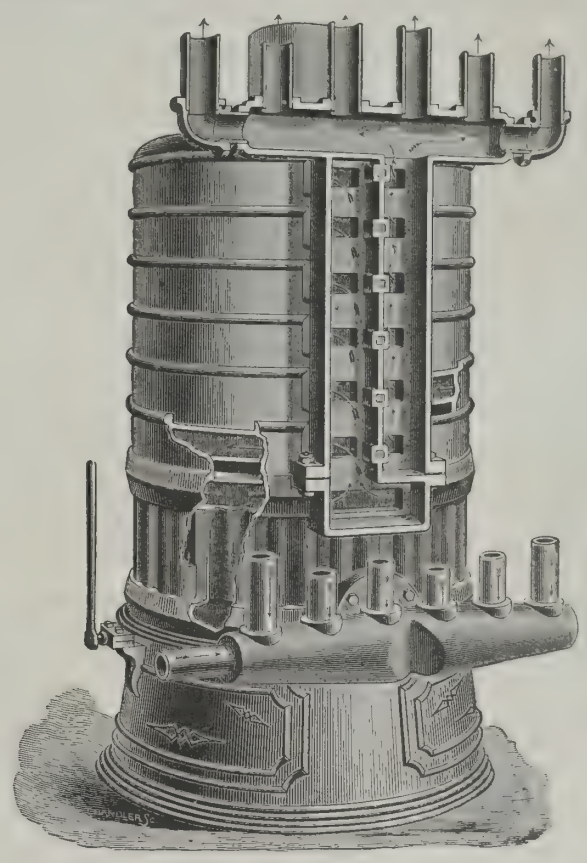

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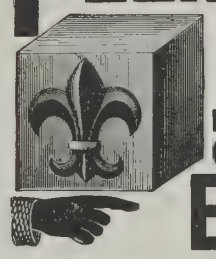

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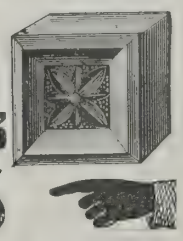
BRICKS



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QUALITY and FINISH UNEQUALED.

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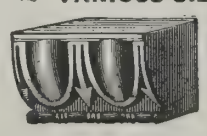

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ARCHES of all kinds ground and fitted from drawings furnished to us. Full size working plans sent with bricks.

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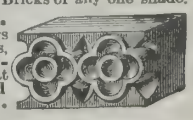

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We are assisted in this work by able architects, and we try to make our estimates reliable, so that the work can be done by any reliable builder at the prices named. Terms moderate.

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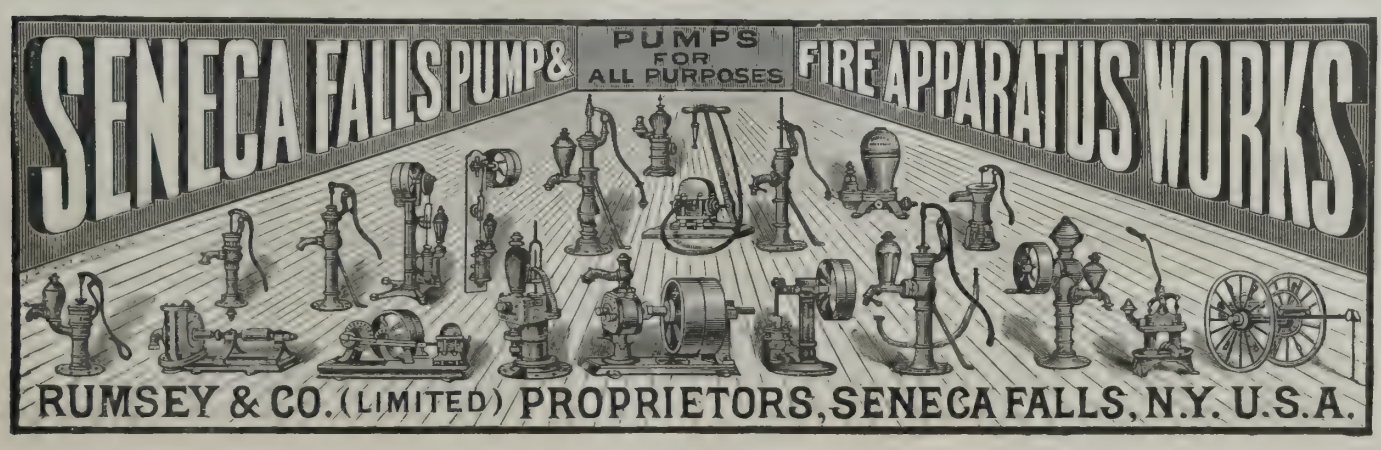

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SEALED PROPOSALS.

May 3, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 5th day of June, 1888, for the labor and materials required in the erection of the extension and additional stories and ironwork of the basement extension of the U. S. Court House, Post Office, etc., building at Brooklyn, N. Y., in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Mechanics' and Traders' Exchange, New York, N. Y.; the Master Builders' Associations at Boston, Mass., and Baltimore, Md.; the Builders' Exchange, Albany, N. Y.; the Builders' Association, Buffalo, N. Y.; the Knights of Labor, Concord, N. H.; the Master Builders' Exchange, Philadelphia, Pa.; and the Virginia Mechanics' Institute, Richmond, Va. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 10, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 7th day of June, 1888, for the labor and materials required in the erection and completion of the Court House, Post Office, etc., building at Williamsport, Pa. (heating apparatus and completion of approaches not included), in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Builders' Exchanges at Pittsburgh, Pa., and Wilmington, Del.; Master Builders' Exchange, Philadelphia, Pa.; Master Builders' Association, Baltimore, Md.; Mechanics' and Traders' Exchange, New York City; Builders' Association, Buffalo, N. Y.; and Builders' and Dealers' Exchange, Cleveland, O. Each bid must be accompanied by a certified check for $1,000. WILL. A. FRERET, Supervising Architect.

May 8, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 5th day of June, 1888, for the labor and materials required in the erection and completion of the superstructure of the U. S. Post Office, etc., building at Springfield, Ohio, including the interior finish of same, entrance steps, etc., in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Master Builders' Association at Baltimore, Md.; the Builders' Exchanges at Cincinnati, Ohio, Columbus, Ohio, and Detroit, Mich.; the Permanent Exhibit and Exchanges at Chicago, Ill.; the Builders' and Traders' Exchange at Louisville, Ky.; and the Builders' and Dealers' Exchange at Cleveland, Ohio. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 14, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 6th day of June, 1888, for the labor and materials required in the erection and completion of the low-pressure return-circulation steam-heating and ventilating apparatus for the U. S. Post Office, etc., building at Terre Haute, Ind., in accordance with the specification and drawings, copies of which, with other information, may be seen on application at this office, at the office of the Superintendent, the Master Builders' Associations at Boston, Mass., and Baltimore, Md.; the Builders' Exchanges at Cincinnati, Ohio, Detroit, Mich., and Milwaukee, Wis.; the Builders' and Dealers' Exchange Co., Cleveland, Ohio; the Builders' and Traders' Exchanges at Chicago, Ill., Kansas City, Mo., and Louisville, Ky.; the Mechanics', Dealers', and Lumbermen's Exchange, New Orleans, La.; the Engineers' Society of Western Pennsylvania at Pittsburgh, Pa.; and the Master Builders' Exchange at Philadelphia, Pa. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 15, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 9th day of June, 1888, for the labor and materials required in the erection and completion of the extension of the U. S. Post Office, Court House, etc., building at Syracuse, New York, in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Master Builders' Exchange, N. Y.; Master Builders' Associations at Boston, Mass., and Baltimore, Md.; Builders' Exchanges, Cincinnati, O., and Pittsburgh, Pa.; Builders' and Dealers' Exchange Co., Cleveland, O.; and the Mechanics' and Traders' Exchange, New York, N. Y. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 19, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 4th day of June, 1888, for the labor and materials required in the erection and completion of the Court House, Post Office, etc., building at Williamsport, Pa. (heating apparatus and completion of approaches not included), in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Builders' Exchanges at Pittsburgh, Pa., and Wilmington, Del.; Master Builders' Exchange, Philadelphia, Pa.; Master Builders' Association, Baltimore, Md.; Mechanics' and Traders' Exchange, New York City; Builders' Association, Buffalo, N. Y.; and Builders' and Dealers' Exchange, Cleveland, O. Each bid must be accompanied by a certified check for $1,000. WILL. A. FRERET, Supervising Architect.

May 19, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 11th day of June, 1888, for the labor and materials required in the erection and completion of the basement and area walls, including excavation, concrete and filling in of lot, for the Court House, Post Office, etc., at Binghamton, N. Y., in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, at the Master Builders' Associations at Albany, N. Y., and Baltimore, Md.; Mechanics' and Traders' Exchange, New York City; Builders' Association, Buffalo, N. Y.; Master Builders' Exchange, Philadelphia, Pa.; Builders' and Dealers' Exchange Co., Cleveland, O; and Knights of Labor, Concord, N. H. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 19, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 6th day of June, 1888, for the labor and materials required in the erection and completion of the low-pressure return-circulation steam-heating and ventilating apparatus for the U. S. Court House and Post Office, etc., building at Peoria, Ill., in accordance with the specification and drawings, copies of which, with other necessary information, may be seen on application at this office, at the office of the Superintendent, the Master Builders' Associations at Boston, Mass., and Baltimore, Md.; the Builders' Exchanges at Cincinnati, Ohio, Detroit, Mich., and Milwaukee, Wis.; the Builders' and Dealers' Exchange Co., Cleveland, Ohio; the Builders' and Traders' Exchanges at Chicago, Ill., Kansas City, Mo., and Louisville, Ky.; the Mechanics', Dealers', and Lumbermen's Exchange, New Orleans, La.; the Engineers' Society of Western Pennsylvania at Pittsburgh, Pa.; and the Master Builders' Exchange at Philadelphia, Pa. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect.

May 22 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 5th day of June, 1888, for the labor and materials required in the erection and completion of the low-pressure return-circulation steam-heating and ventilating apparatus for the U. S. Court House, Post Office, etc., building at Clarksburgh, W. Va., in accordance with the specification and drawings, copies of which, with other necessary information, may be seen on application at this office, at the office of the Superintendent, the Master Builders' Associations at Boston, Mass., Baltimore, Md.; Builders' Exchanges at Cincinnati, Ohio, Detroit, Mich., and Milwaukee, Wis.; Builders' and Dealers' Exchange Company at Cleveland, Ohio; Builders' and Traders' Exchanges at Chicago, Ill., Kansas City, Mo., and Louisville, Ky.; Mechanics', Dealers', and Lumbermen's Exchange, New Orleans, La.; Engineers' Society of Western Pennsylvania at Pittsburgh, Penn.; and the Master Builders' Exchange, Philadelphia, Pa. Each bid must be accompanied by a certified check for $300. WILL. A. FRERET, Supervising Architect.

May 22, 1888. Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M. on the 7th day of June, 1888, for the labor and materials required in the completion of the approaches for the Court House and Post Office building at New Albany, Ind., in accordance with the specification and drawings, copies of which may be seen at this office, the office of the Superintendent, the Builders' Exchange, Cincinnati, O.; Master Builders' Association, Baltimore, Md.; Builders' and Traders' Exchange, Chicago, Ill.; Builders' and Traders' Exchange, Louisville, Ky.; Builders' Exchange, Indianapolis, Ind.; Builders' and Dealers' Exchange Co., Cleveland, O.; and the Builders' Exchange, Detroit, Mich. Each bid must be accompanied by a certified check for $500. WILL. A. FRERET, Supervising Architect

Classified Index of Advertisements Published in the Present Number of the Scientific American, Architects and Builders Edition.

CLASSIFIED ADVERTISEMENTS.—Continued from page xiii.

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